DWU Standard Protocol for Soil and Groundwater Management on Construction Sites (Version 1)

November 4, 2011

Prepared by:

Dallas Water Utilities and

Terracon Consultants, Inc.

Dallas, Texas

Important Note: This document and associated appendices are for use by DWU staff, consultants, and contractors on DWU-led and DWU-joint projects only. Use of, or reliance on, this document by outside parties for non-DWU projects is strictly prohibited. This document is also considered to be a draft document that may undergo future revisions and/or amendments by DWU as well as updates.

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COMMON ACRONYMS

BGS (bgs):	Below Grade/Ground Surface
BTEX:	Benzene, Toluene, Ethylbenzene, and Xylenes
COC:	Chemical of Concern (Contaminant)
DNAPL:	Dense Non-Aqueous Phase Liquid
EPA:	United States Environmental Protection Agency
ESA:	Environmental Site Assessment (Phase I or Phase II)
HASP:	Health & Safety Plan
IOP:	Innocent Owner/Operator Program (TCEQ)
LNAPL:	Light Non-Aqueous Phase Liquid
LPST:	Leaking Petroleum Storage Tank (TCEQ)
MTBE:	Methyl Tert-Butyl Ether
NAPL:	Non-Aqueous Phase Liquid
PAHs:	Polycyclic Aromatic Hydrocarbons
PCBs:	Polychlorinated Biphenyls
PCE/PERC:	Perchloroethene or Perchloroethylene, aka Tetrachloroethene or Tetrachloroethylene
PID:	Photoionization Detector
ppb:	Parts Per Billion
ppm:	Parts Per Million
PST:	Petroleum Storage Tank (TCEQ)
REC:	Recognized Environmental Condition
RP:	Responsible Party
SVOCs:	Semi-Volatile Organic Compounds
TCE:	Trichloroethylene
TCEQ:	Texas Commission on Environmental Quality
UST:	Underground Storage Tank
VCP:	Voluntary Cleanup Program (TCEQ)
VOCs:	Volatile Organic Compounds

DWU SITE SCREENING AND SGMP PROCESS FLOWCHART

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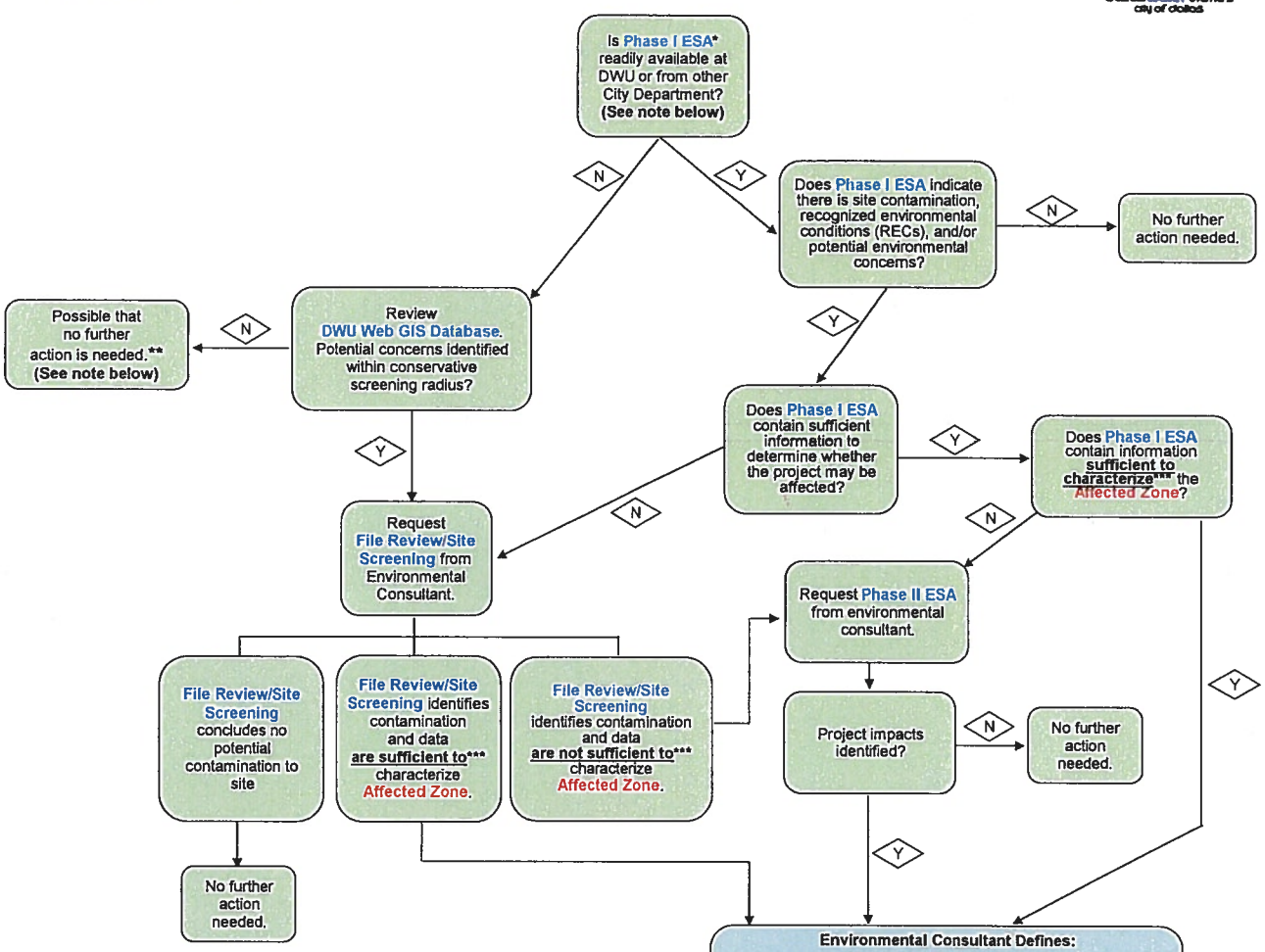

NOTES:

*An ASTM E 1527-05 Compliant Phase I ESA is required for all City of Dallas projects involving property acquisitions. Refer to Page 2 of Manual. Phase I ESAs may be available from the City of Dallas Office of Environmental Quality (OEQ) or other City Departments.

**Refer to Important Notes regarding use of DWU Web GIS on Pages 3 to 4 of Manual if the database is sole source of information used to make a determination that no further action is needed.

***The determination on whether data obtained through the File Review/Site Screening Process are sufficient to characterize the Affected Zone is to be made by the Environmental Consultant that completed this service. Refer to Page 7 of Manual and the File Review/Site Screening Contents Checklist (Appendix B).

MANUAL REFERENCES:

- Section 2.0
- Section 3.0
- Section 4.0
- Section 6.0
- Section 7.0
- Section 8.0

See Appendix B for the **File Review/Site Screening Contents Checklist**

See Appendix C for the **Phase II ESA Contents Checklist**

See Appendix D for the **DWU Site Summary Document**

See Appendix E for the **Project-Specific SGMP Contents Checklist**

ROLES AND RESPONSIBILITIES CHART

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TASKS	DWU Engineer/PM	Design Consultant	Environmental Consultant*	Contractor	DWU Inspector	Office of Environmental Quality
Review DWU Web GIS for Environmental Concerns	X					
Review Existing Phase I/Phase II ESAs (If Available)			X			X
Conduct File Review/Site Screening			X			
Conduct Phase II ESA			X			
Define Affected Zone Limits			X			
Evaluate Presence of NAPL			X			
Designate Contaminant Condition (Low, High, Unacceptable)			X			
Select Appropriate Materials and Embedment Specifications		X				
Approve Materials and Embedment Specification Selections	X					
Complete DWU Site Summary Document (Appendix D)**	X	X	X			
Prepare DWU Health & Safety Plan	X					
Prepare Project-Specific Soil & Groundwater Management Plan (SGMP)			X			
Prepare Contractor Health & Safety Plan				X		
Review and Implement Project-Specific SGMP				X		
Oversee and Manage Implementation of Project-Specific SGMP			X			
Collect Soil/Groundwater Samples and Complete Landfill Profiles			X			
Stage, Transport, and Dispose of Contaminated Soils (Class I and II Non-Hazardous)				X		
Stage, Transport, and Dispose of Contaminated Soils (Hazardous)			X			
Stage, Transport, and Dispose of Contaminated Groundwater				X		
General Utility Inspection					X	
Provide General Environmental Support - Including Reviewing Existing Environmental Reports, Answering DWU Environmental Questions, and Aiding in Selection of Appropriate Consultants and Contractors for Projects						X

*Selecting the same environmental consultant for all phases of a particular project (i.e., site evaluation, Project-Specific SGMP preparation, and soil and groundwater management oversight) generally improves project consistency and efficiency. However, the use of different environmental consultatns on different project phases may be benficial if a second opinion is desired, or if DWU finds that certain consultants perform particlarly well on certain project phases.

**The DWU Site Summary Document (Appendix D) contains sections to be filled out by the DWU Engineer/PM, the environmental consultant, and the design consultant. The DWU Engineer/PM may complete the document utilizing pertinent information provided by the environmental and desing consultants or may have these consultants complete applciable sections of the document. Regardless, it is the responsibility of the DWU Engineer/PM to review the completed document for accuracy and proper materials/design selections.

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DWU STANDARD PROTOCOL FOR SOIL AND GROUNDWATER MANAGEMENT ON CONSTRUCTION SITES

Version 1: Prepared November 4, 2011

1.0 INTRODUCTION AND PURPOSE

The purpose of this standard protocol manual is to provide instruction and guidance to Dallas Water Utilities (DWU) employees for evaluating and addressing potential environmental contamination issues associated with utility construction projects. The manual provides guidelines, a decision framework, and basic information for DWU reference when evaluating environmental aspects of project planning and utility design/construction in areas anticipated to contain chemicals of concern (COCs).

It should be noted that the text of this standard protocol manual contains condensed information and guidelines and is intended to serve as a "desktop" reference document. Detailed supplemental information is available in Appendices A through M of this document.

This document and associated appendices are for use by DWU staff, consultants, and contractors on DWU-led and DWU-joint projects only. Use of, or reliance on, this document by outside parties for non-DWU projects is strictly prohibited. This document is also considered to be a draft document that may undergo future revisions and/or amendments by DWU, and will be updated to reflect changes to pertinent regulatory databases and risk-based standards.

The intent of the decision framework in this manual is to assist employees in identifying potential contaminated locations in advance and making proper project design and management decisions when environmental contamination is present or suspected to be present. The overall objectives of the soil and groundwater management plan (SGMP) process are to improve cost-effectiveness and efficiency of projects at contaminated sites, ensure a safe working environment, and help protect the City of Dallas' water distribution and wastewater collection lines from COCs. The overall SGMP process is summarized on the **DWU Site Screening and SGMP Process Flowchart (Page iii)**. The following standard protocol manual follows the general order of the overall process flowchart and expands on each item. Roles and responsibilities for the parties involved in the process are outlined on the **Roles and Responsibilities Chart (Page iv).**

Portions of the standard protocol will involve retaining an approved Environmental Consultant from the list of City of Dallas approved vendors. This work should be conducted under the existing *Geotechnical, Environmental, and Laboratory Services Master Agreement (BDZ0903)*. The City of Dallas Office of Environmental Quality (OEQ, http://www.dallascityhall.com/oeq/index.html) is also available as a source of environmental information and can provide assistance with reviewing and evaluating environmental documents, evaluating potential concerns, and selecting qualified Environmental Consultants.

2.0 STEPS FOR EVALUATING POTENTIAL FOR CONTAMINATION

Evaluation of the potential for contamination should be conducted early in the project planning phase because the presence of contamination may affect subsequent stages in the project planning process. Common sources of COCs that may be encountered during DWU projects include but are not limited to filling stations/convenience stores, dry cleaners, auto repair or maintenance facilities, active or closed landfills, and a variety of industrial and manufacturing facilities that use chemicals in their on-site processes. Refer to **Appendix G** for more information on the common sources of COCs as well as information on the COCs themselves.

Various methods can be utilized to evaluate sites for the presence or potential presence of COCs, including:

- Existing Phase I Environmental Site Assessments (ESAs);
- Review of the DWU Pipeline Geographic Information System (GIS);
- Completion of TCEQ or Federal regulatory file reviews; and
- Phase II ESAs (subsurface investigations).

The site screening and evaluation process utilizing the above tools is summarized on **Chart 1 (Appendix A)**. In addition, **Example Site Scenario 1 (Appendix F)** provides an example of how to evaluate the potential for contamination at project sites. The general process includes the following review steps:

STEP 1 – Phase I ESA Review (For Acquisitions Only)

The City of Dallas requires that Phase I ESAs be conducted as part of acquisition projects. If the project involves an acquisition, determine if a Phase I ESA is readily available at DWU, from the OEQ, or from another City of Dallas department.

- ***If the project involves an acquisition and no Phase I ESA is available, order a Phase I ESA from an approved Environmental Consultant.***

- ***If the project does not involve an acquisition and no Phase I ESA is available, it is recommended to skip Step 1 and proceed to Step 2 (DWU Web GIS) and Step 3 (File Review/Site Screening).***

Review the Phase I ESA to determine if the Environmental Consultant has identified any recognized environmental conditions (RECs), potential environmental concerns, or if the consultant concluded that COCs were present or potentially present on the site. A REC is defined by ASTM as the "*presence or likely presence of any hazardous substances or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of*

any hazardous substances or petroleum products into structures on the property or into the ground, ground water, or surface water of the property". Potential environmental concerns can include a broad range of items, but generally refer to environmental concerns that are not serious enough to be classified by the Environmental Consultant as RECs (i.e., they did not meet the ASTM technical definition of a REC).

Review of the Phase I ESA will generally result in one of the following three scenarios:

1) If site contamination, RECs, or potential environmental concerns were not identified and the Phase I ESA was recently completed (i.e., within 180 days), project planning may proceed without special regard to site contamination.

2) If site contamination, RECs, or potential environmental concerns were not identified but the Phase I ESA is greater than 180 days old, consult with an approved Environmental Consultant or the OEQ regarding the validity of the ESA with respect to the project objectives.

3) If site contamination or potential environmental concerns were identified, have an approved Environmental Consultant or the OEQ review the Phase I ESA to determine if the report contains sufficient information to define the Affected Zone and characterize the COCs at the site. The Environmental Consultant may recommend a regulatory file review (see Step 3) or Phase II ESA (see Step 4) at the site to better evaluate the soil and/or groundwater contamination if additional information is needed.

STEP 2 – DWU Web GIS

The DWU Web GIS – DWU Utility Automation and Integration (UAI) mapping system has layers intended to assist in the identification of potential contaminated sites located in the Dallas area if a Phase I ESA is not required or readily available. Information from the system can also be utilized to supplement information from Phase I ESAs. The primary intent of the GIS database is to provide a useful screening tool to quickly evaluate the potential for contamination in the vicinity of projects.

A) Search the DWU Web GIS Database

Prior to beginning a project, DWU personnel should review the DWU Web GIS database at http://dwu.cod/dwu%20web%20dev/. Search under environmental points of interest for potential contamination located on or near a project site. Refer to **Table 1** on the following page for a listing of the various environmental points of interest.

Important Notes Regarding Use of GIS System:

Please note that all contaminated properties in the Dallas area are not plotted on the GIS map. Additionally, the GIS map relies on information available from the TCEQ concerning regulated facilities and does not typically include information on potential historic facilities (i.e., gasoline stations and dry cleaners) that operated prior to registration requirements or other unregistered

Important Notes Regarding Use of GIS System (Cont.):

facilities where contamination may be present unbeknownst to the TCEQ; therefore, solely relying on information from the GIS database may not identify all potentially-contaminated properties.

It should also be noted that project sites reported by the TCEQ as "closed", "terminated", or "completed" are not necessarily an indicator that all contaminants on the property were remediated or removed. These terms generally refer to sites where contaminants were remediated to meet risk-based standards but where contaminants were likely left in place in the on-site soils and/or groundwater. This residual contamination will still need to be considered in the SGMP for the site.

For the above reasons, the GIS database will best function as a screening and informational tool in connection with other resources such as a Phase I ESA, File Review/Site Screening, and/or professional input or review by an approved Environmental Consultant. ***If the DWU GIS Database is the sole source of information used to make a determination that no further action is needed, special consideration of the above-listed important notes should be taken to ensure this determination is suitable for the site-specific case.***

Table 1: DWU Web GIS – Environmental Points of Interest

Petroleum Storage Tank (PST)	PST facilities are those with current and/or former registered PSTs (e.g., filling stations, fleet refueling, etc.). PSTs can be aboveground storage tanks (ASTs) or underground storage tanks (USTs). It should be noted that a PST facility has not necessarily had a documented release (as is the case with LPST facilities), but the potential for contamination still exists due to the presence of USTs and a high potential for releases from UST systems. ***Source: TCEQ*** http://www.tceq.state.tx.us/permitting/registration/pst/pst_query.html
Leaking Petroleum Storage Tank (LPST)	LPST facilities are those where a release of petroleum substance from a regulated PST has been confirmed. ***Source: TCEQ*** http://www.tceq.state.tx.us/remediation/pst_rp/pstquery.html
Voluntary Cleanup Program (VCP) Site	A VCP site indicates that there is ongoing or completed site remediation by a private party or parties who contributed to the contaminants in that area or own the property. ***Source: TCEQ*** http://www.tceq.texas.gov/remediation/vcp/vcp.html#Database
Municipal Setting Designation (MSD)	An MSD is an institutional control restricting the use of groundwater as a potable water source. MSD properties are an indicator of the presence of contaminants in soils and/or groundwater. ***Source: City of Dallas Office of Environmental Quality (OEQ)***

Table 1: DWU Web GIS – Environmental Points of Interest (Cont.)	
Registered Dry Cleaner	The TCEQ maintains a database of registered dry cleaning facilities. The presence of a dry cleaning facility in the database indicates that the facility is registered but does not necessarily indicate that a release has been confirmed at the facility. The dry cleaning listing may also indicate whether the facility is a drop station (i.e., actual dry cleaning process is not conducted at the facility). ***Source: TCEQ*** http://www5.tceq.state.tx.us/dcr2_dpa/
Innocent Owner/Operator Program (IOP)	A property in the IOP suggests that soils and/or groundwater at the property, and possibly in the vicinity of the property, are impacted by a source of contamination not located on, but in the vicinity of, the IOP property. ***Source: TCEQ*** http://www.tceq.texas.gov/remediation/iop/iop.html#database
Monitoring Wells	The GIS provides locations for monitoring wells registered with the Texas Water Development Board (TWDB). If monitoring wells are located on or in proximity to a project site, it may indicate potential groundwater contamination and a File Review/Site Screening should be considered. ***Source: TWDB*** https://texaswellreports.twdb.state.tx.us/drillers-new/index.asp
Landfills	The DWU Web GIS provides the name of the landfill and acreage of the landfill. Additional information pertaining to City-owned landfills can be found on the City of Dallas website under sanitation services at: http://www.dallascityhall.com/sanitation/disposal_operations.html. In addition, information pertaining to closed and abandoned landfills in the North Texas area is available from the North Central Texas Council of Governments (NCTCOG) at: http://www.nctcog.org/envir/SEELT/disposal/facilities/cli_main.asp.
Federal or State Superfund Facility	Federal or State Superfund facilities typically involve significant contamination of soils and groundwater that warrant assessment and cleanup utilizing Federal or State funds and may involve extensive contamination in the facility vicinity. ***Sources: U.S. EPA and TCEQ*** http://www.epa.gov/superfund/ http://www.tceq.texas.gov/remediation/superfund/registry.html http://www.epa-echo.gov/echo/

B) Evaluating Proximity to Environmental Points of Interest

If the project site is located in proximity to one of the environmental points of interest listed in **Table 1**, order a regulatory File Review/Site Screening from an approved Environmental Consultant (refer to Step 3). Utilize the following table (**Table 2**) as a guideline on when to order a File Review/Site Screening.

Table 2: Evaluating Project Proximity to Environmental Points of Interest

Environmental Point of Interest	Order File Review/Site Screening if Environmental Point of Interest is within a Radius of:
Leaking Petroleum Storage Tank (LPST)[1]	1,000 feet
Petroleum Storage Tank (PST)[1]	500 feet
Voluntary Cleanup Program (VCP)[1]	1,000 feet
Municipal Setting Designation (MSD)[2]	1,000 feet
Registered Dry Cleaner[1]	1,000 feet
Innocent Owner/Operator Program (IOP)[1]	1,000 feet
Monitoring Wells[3]	200 feet
Landfills (Open or Closed)[4,5]	1,000 feet
Federal or State Superfund Facility[6,1]	1,000 feet

Sources = [1]TCEQ; [2]City of Dallas OEQ; [3]TWDB; [4]City of Dallas Sanitation; [5]NCTCOG; [6]EPA

STEP 3 – File Review/Site Screening

If a Phase I ESA is not available and review of the DWU Web GIS does not provide sufficient information necessary to determine if contaminants may be located in the vicinity of the project, a File Review/Site Screening should be requested from an approved Environmental Consultant. A File Review/Site Screening may alternatively be requested as the initial step in the site evaluation process.

The File Review/Site Screening should provide similar information as would be obtained from the Phase I ESA or DWU Web GIS system and will generally provide information that is more-closely targeted to the project objectives. This targeted approach should yield the necessary information at a reduced cost and schedule as compared to a full Phase I ESA. ***However, it should be noted that completion of an ASTM-compliant Phase I ESA is required by the City of Dallas in the case of a property acquisition to provide DWU and the City of Dallas with the associated liability protections.***

The **File Review/Site Screening Contents Checklist (Appendix B)** should be provided to the Environmental Consultant prior to the file review so that the appropriate information is included. The File Review/Site Screening is intended to provide focused historical and regulatory information on potential sources of COCs with regards to the proposed project area and design. The objective is to acquire targeted information relevant to evaluation of potential COCs at a project site rather than conduct a Phase I ESA compliant with ASTM 1527-05.

In general, the File Review/Site Screening will include:

- A review of TCEQ and Federal regulatory databases;
- A review of specific TCEQ files as applicable (e.g., VCP or LPST facilities);
- A review of historical records (e.g., aerial photographs, city directories, and Sanborn maps);
- A review of local records and permits;
- A review of condition of project area and vicinity during limited site reconnaissance;
- **A determination on whether potential environmental concerns exist and whether a Phase II ESA is warranted to evaluate COCs at the site with respect to the project;**
- **If analytical data pertinent to the project are discovered during the file review, a professional opinion on whether the data are sufficient to adequately characterize the Affected Zone and preclude the need for additional investigation; and**
- **If the analytical data are sufficient to characterize the Affected Zone, a designation of the contaminant condition as Low, High, or Unacceptable using Charts 1 and 2 of this Manual (further discussed in Section 3.0).**

Upon review of the File Review/Site Screening, check to make sure the Environmental Consultant adequately addressed the items in the contents checklist. Specifically, make sure that the Environmental Consultant provides the three bolded items listed above pertaining to the need for additional investigation (i.e., a Phase II ESA).

Evaluation of Existing Phase II ESAs (Subsurface Investigations)

Existing Phase II ESAs or soil and/or groundwater data from other subsurface investigation work may also be available for review and should be summarized in the File Review/Site Screening. The existing data should be reviewed to determine if the scope is adequate to characterize the Affected Zone as it pertains to the project. Please note that the objectives of the existing Phase II ESA were likely associated with release determination or property due diligence and may have not focused on soil or groundwater locations or intervals pertinent to the DWU utility project. The age of the Phase II ESA should also be taken into consideration. Environmental conditions in the subsurface can change relatively quickly based on a number of factors. An approved Environmental Consultant or

the OEQ should be contacted if there are questions regarding the adequacy or age of existing Phase II ESAs with respect to effectively characterizing the Affected Zone at or near a project. To be utilized effectively, the results of existing Phase II ESAs should generally satisfy the Phase II ESA deliverable requirements outlined below in Step 4.

> *Important Note: In some cases, analytical data may be available through the regulatory file review process (e.g., soil and groundwater data for an adjacent LPST facility) and this data may be sufficient to characterize the Affected Zone as it pertains to the project. In this case, a Phase II ESA may not be necessary or a Phase II ESA with a modified/reduced scope may be sufficient to supplement the existing analytical data. The decision on whether a Phase II ESA is still warranted should be made by the Environmental Consultant or the OEQ.*

STEP 4 – Phase II ESA (Subsurface Investigation)

If review of the Phase I ESA, DWU Web GIS, and/or File Review/Site Screening indicate the potential for contamination at the site, a Phase II ESA should be requested from an approved Environmental Consultant to evaluate the concentrations of COCs in the on-site soil and/or groundwater. When requesting a Phase II ESA, DWU personnel should provide available information on the location, depth, and proposed design of the utility project to the Environmental Consultant so that a scope of work focused on the project objectives can be developed.

DWU should specifically request that the Phase II ESA deliverable contain:

1) ***a to-scale site map depicting the locations of the collected soil and/or groundwater samples and clearly depicting the location and extent of the Affected Zone(s);***
2) ***a to-scale geologic cross-section depicting, as applicable, the different soil zones, the water table, the locations of the affected soil and/or groundwater, and the proposed utility;***
3) ***a professional opinion on whether the data and results have adequately characterized the Affected Zone(s) with respect to DWU project objectives;***
4) ***a professional opinion on whether non-aqueous phase liquid (NAPL) exists, or may have reasonable potential to exist based on the analytical data, in soils and/or groundwater at or near the project site;***
5) ***a designation of the contaminant condition as Low, High, or Unacceptable using Charts 1 and 2 of this manual (further discussed in Section 3.0); and***
6) *a professional opinion on the stability of the Affected Zone in soil and/or groundwater and whether there is a potential for the extent of the Affected Zone to change in the future, thus warranting special design considerations.*

The scope of the requested Phase II ESA may vary significantly based on a number of factors including but not limited to: 1) the amount of existing information from the File Review/Site Screening or past subsurface investigations; 2) the proximity of the utility project to the suspected source of contamination; 3) the depth and proposed design specifications of the utility project; 4) the geology and depth to groundwater; and 5) the types of COCs involved (e.g., petroleum hydrocarbons and/or chlorinated solvents).

The **Phase II ESA Contents Checklist (Appendix C)** should be provided to the Environmental Consultant prior to the Phase II ESA so that the appropriate information is included.

3.0 CONTAMINANT CONDITION AND DESIGN SPECIFICATIONS

The soil and/or groundwater analytical data collected at the project site are evaluated to determine whether specific material and/or design selections and procedures are warranted to:

1) Protect the integrity of the utility;

2) Prevent potential exacerbation of the contamination by not creating preferential contaminant migration pathways; and

3) Ensure proper construction worker health and safety procedures are in place.

STEP 1 – Designating Low, High, or Unacceptable Contaminant Condition (Done by Environmental Consultant)

The Environmental Consultant should designate the contaminant condition as Low, High, or Unacceptable using the following process and **Charts 1 and 2 (Appendix A)**. This designation should be provided to DWU in the File Review/Site Screening and/or Phase II ESA deliverable.

Analytical data obtained during the File Review/Site Screening and/or Phase II ESA conducted as part of the site evaluation process should be evaluated using **Charts 1 and 2 (Appendix A)**, which are designed to designate Low, High, or Unacceptable Contaminant Conditions.

Important Note: At this time in the process, it is important to ensure that adequate analytical data (i.e., proper numbers of samples, sample locations, and analyses) were collected to sufficiently characterize the Affected Zone at the project site before proceeding with use of the COC evaluation charts. This evaluation should be conducted by an approved Environmental Consultant due to the many variables involved with project-specific cases. As previously mentioned on page 7 of this manual, DWU should specifically request that the Phase II ESA deliverable include a professional opinion from the Environmental Consultant on whether the data and results have adequately characterized the Affected Zone with respect to DWU project objectives. If DWU is relying on existing Phase II ESA data, an approved Environmental Consultant or the OEQ should be contacted to review the information and provide an opinion on whether the data have adequately characterized the Affected Zone.

Using Chart 1: COC Evaluation Chart – Soils

Chart 1 (**Appendix A**) should be utilized to evaluate the soil analytical data as follows:

- Compare the detected soil COC concentrations to the provided concentration ranges for Low or High Contaminant Conditions provided in the chart for various COCs.
- The overall contaminant condition will be determined by the highest degree of contamination amongst the various COCs. For example, if the majority of petroleum hydrocarbon COCs (e.g., toluene, ethylbenzene, trimethylbenzenes, etc.) are detected in soils within the Low Contaminant Condition range but one of the COCs (e.g., benzene) is detected in the High Contaminant Condition range, the overall contaminant condition applied for the project area will be the High Contaminant Condition.
- Unacceptable Contaminant Conditions include the presence of visible Non-Aqueous Phase Liquid (NAPL), which is essentially free-phase product (explained on pages 11-12), or COC concentrations approaching numerical limits indicating the potential presence of NAPL.

Using Chart 2: COC Evaluation Chart – Groundwater

COCs in groundwater should be evaluated using this process in situations where:

1) the utility excavation encounters shallow groundwater at any point; or

2) where the maximum depth of the utility excavation at any point is below the anticipated seasonal high water table at the site.

Since long-term data on groundwater table fluctuations will not be common at most project sites, a conservative estimation of the potential high water table should be determined using available site data and input from a qualified environmental professional.

Chart 2 (**Appendix A**) should be utilized to evaluate the groundwater analytical data as follows:

- Compare the detected groundwater COC concentrations to the provided concentration ranges for Low, High, or Unacceptable Contaminant Conditions provided in the chart for various COCs.
- The overall contaminant condition will be determined by the highest degree of contamination amongst the various COCs. For example, if the majority of petroleum hydrocarbon COCs (e.g., toluene, ethylbenzene, trimethylbenzenes, etc.) are detected in groundwater within the Low Contaminant Condition range, but one of the COCs (e.g., benzene) is detected in the High Contaminant Condition range, the overall contaminant condition applied for the project area will be the High Contaminant Condition.

- Unacceptable Contaminant Conditions include the presence of visible NAPL or COC concentrations approaching theoretical solubility limits or effective solubility limits for petroleum mixtures and suggesting the potential for NAPL.

NAPL Defined

Non-Aqueous Phase Liquid (NAPL) – Contaminants that do not fully dissolve in water, remain undiluted as the original bulk liquid in the subsurface, and/or are present at concentrations greater than their solubility limit.

Light Non-Aqueous Phase Liquid (LNAPL) – NAPL that is less dense than water (i.e., has a specific gravity less than 1) and floats on top of the groundwater surface. Common examples include gasoline, diesel, and oil. LNAPL will be the most common form of NAPL encountered on DWU projects. **Figure 1** shows weathered gasoline LNAPL floating on top of a groundwater sample collected in a vial. **Figure 3** (following page) shows an example of petroleum LNAPL floating on top of water present inside an excavation.

Figure 1: Weathered gasoline LNAPL floating on top of a groundwater sample.

Important Notes Regarding NAPL:

- *NAPL may be present even if it is not directly observed. Sheen on water or soil may be indicative of a nearby NAPL source.*
- *Additionally, dissolved-phase concentrations approaching contaminant solubility limits in groundwater or theoretical soil saturation limits in soils may be indicative of nearby NAPL or conditions in which NAPL may form.*
- *NAPL color will vary based on the degree of product weathering and subsurface conditions.*
- *NAPL in soils is typically harder to identify visually and may appear as product globules or sheen (e.g., a "shiny" liquid) present in or on soil particles or aggregates. The general rule of thumb for petroleum products is that mobile NAPL is reasonably anticipated when total petroleum hydrocarbon (TPH) concentrations exceed 10,000 mg/kg.* ***Figure 2*** *is a schematic depicting the presence of residual NAPL on soil aggregates. If necessary, a qualified Environmental Consultant should be obtained to provide a professional opinion on whether NAPL is present in soils.*

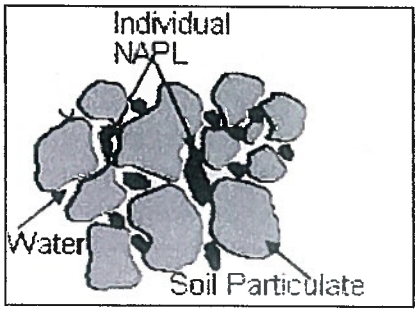

Figure 2: Schematic of residual NAPL in soil.

NAPL Defined (Cont.)

Dense Non-Aqueous Phase Liquid (DNAPL) – NAPL that is denser than water (i.e., has a specific gravity greater than 1) and sinks within a groundwater zone, typically accumulating on a non-permeable confining layer or bedrock surface at the base of the groundwater bearing unit. A common example is the dry cleaning solvent tetrachloroethene (aka, perchloroethene, PCE, or PERC). DNAPL will be encountered less commonly on DWU projects. **Figure 4** shows an example of PERC DNAPL lying below a groundwater sample.

Figure 3: Petroleum LNAPL observed on top of water present inside an excavation.

Figure 4: Weathered PERC DNAPL lying below a groundwater sample.

STEP 2 – Construction Materials and Design Selection (Done by Pipeline Design Consultant and Approved by DWU)

Once the contaminant condition is determined, utilize **Chart 3 (Appendix A)** to determine whether the initial materials and design specifications selected for the project based on DWU design criteria are suitable for the subject contaminant condition. If the initial materials and design are not suitable, utilize the chart to determine alternate material and design options that are suitable for the subject contaminant condition. This chart contains a matrix indicating whether a variety of materials and design options utilized by DWU are acceptable or should be avoided for Low or High Contaminant Conditions. Sample alternative embedment specifications are also located in **Appendix A**.

Important Note: It should be noted that there are no materials or embedment specifications that may be used for Unacceptable Contaminant Conditions (i.e., the presence or likely presence of NAPL). Options for addressing Unacceptable Contaminant Conditions include: a) removal or remediation of the NAPL prior to construction; b) relocation of the project or modification of the design to avoid the zone affected by NAPL; or c) and in-depth site-specific evaluation by an Environmental Consultant to evaluate the situation and present suitable options for proceeding with the project.

Please note that design selections and engineering controls beyond those outlined in **Chart 3** may be warranted in areas where sensitive receptors such as water supply wells or surface waters are nearby to minimize contaminant contact with the subject utility and/or to prevent or reduce the acceleration of contaminant transport caused by creating preferential contaminant migration pathways. These decisions will need to be made on a site-specific basis with input of senior DWU design staff and possible input by an approved Environmental Consultant if deemed warranted.

*Important Note: It is also important to note that **Chart 3** is intended for use by DWU staff, consultants, and contractors on DWU-led and DWU-joint projects only. DWU personnel are to approve the final decisions regarding which materials and design specifications are utilized on a given project.*

Special Materials and Design Considerations for Work at Landfills

DWU projects may involve sections that are located in or near active or closed landfills. When the project is located in or near a landfill, special considerations in addition to evaluating and addressing the presence of COCs in soils and groundwater are warranted. These considerations include:

- Authorization from the TCEQ will likely be required to disturb the landfill final cover and work will need to be conducted in accordance with the requirements outlined in Title 30 of the Texas Administrative Code, Chapter 330 (30 TAC 330). Refer to 30 TAC §330.960 for specific contents of the *Authorization Request to Disturb Final Cover Over a Closed Municipal Solid Waste (MSW) Landfill for Non-Enclosed Structures*;

- Methane gas is typically present in and around landfills and poses an explosion hazard when present at concentrations exceeding the lower explosive limit (LEL) of 5%. Special health and safety precautions should thus be employed by the contractors working at the site. Additionally, designs for utilities, utility manholes, and ancillary structures should allow for proper venting of methane and should not create enclosed environments in which methane could accumulate at concentrations above the LEL;

- Methane distribution and movement in the subsurface is a complicated process and movement of methane along subsurface utility corridors has been documented. Design considerations should include actions or methods to mitigate the preferential movement of methane along the subsurface utility; and

- TCEQ regulations require that MSW removed when disturbing landfills be properly handled, profiled, and disposed at an approved off-site receiving facility. Unlike contaminated soils, replacement of MSW inside the utility excavation or trench is not allowed.

An alternative embedment specification for use within or near landfills is included in **Appendix A**. When utility work is conducted within landfills, a professional engineer with MSW project experience should be involved to ensure work is conducted in accordance with the requirements of 30 TAC 330 and that the utility design specifications are adequate to mitigate the accumulation and/or preferential migration of methane.

4.0 PREPARING DWU SITE SUMMARY DOCUMENT

The purpose of the **DWU Site Summary Document (Appendix D)** is to summarize pertinent information concerning the Affected Zone at the project site and the associated DWU-selected materials and design specifications for DWU staff, the Environmental Consultant, the pipeline Design Consultant, and the Contractor.

The DWU Site Summary Document will be completed by DWU after:

1) The Affected Zone has been defined by the Environmental Consultant;

2) The contaminant condition has been designated (e.g., Low, High, or Unacceptable) by the Environmental Consultant; and

3) The appropriate materials and design specifications for the contaminant condition have been selected by the Design Consultant and approved by DWU.

DWU may alternatively have the Environmental Consultant and Design Consultant complete the applicable sections of the document.

In general, the DWU Site Summary Document should include the following information:

- Location and depth of the subject project;
- Description of soil types within project area;
- Depth to groundwater, if applicable;
- Clearly defined boundaries of the Affected Zone;
- Description of impacted media (e.g., soil and/or groundwater);
- Types of COCs present in the Affected Zone and maximum concentrations of each COC in soil and/or groundwater;
- DWU designated contaminant condition (Low, High, or Unacceptable);
- Materials and design specifications selected by the Design Consultant based on the degree of contamination and approved by DWU; and
- Estimate of amount of impacted soils anticipated to be displaced by utility installation and require off-site transportation and disposal.

The DWU Site Summary Document will serve as a valuable reference for pertinent site information for DWU personnel involved with the project. The information provided in this summary document will also provide the information necessary for the Environmental Consultant to prepare a **Project-Specific Soil and Groundwater Management Plan** (see Section 6.0).

5.0 DWU RESPONSIBILITIES AND REGULATORY CONSIDERATIONS

The most important consideration with regard to contamination at utility construction sites is that DWU, or the City of Dallas, will seldom be the entity that actually caused the contamination. In most instances, adjacent commercial/industrial properties outside of the right-of-way (ROW) will be the source of contamination found in the ROW or utility easement. It is in DWU's best interest to not be identified as the responsible party (RP) by a regulatory agency and to not automatically accept obligations for investigating or delineating identified contamination beyond what is necessary to safely and responsibly conduct the utility construction project. Alternatively, DWU should develop a sufficient understanding of the nature of adjacent off-ROW contaminant source areas to make informed decisions concerning the possible migration and presence of contaminants in the construction area.

Waste Disposal Considerations and Texas Risk Reduction Program (TRRP) Utility Exclusion

Unless the actual RP is identified in advance and accepts responsibility for the contamination, DWU will normally become the generator and responsible party for contaminated trench media (soil, groundwater, and/or contaminated construction debris) that become waste when removed from the construction area. On occasion, a contractor may contractually agree to accept ownership and responsibility for such waste, but this will not be a typical arrangement. Waste disposal can quickly become a considerable expense that generally increases with increased degree of contamination.

To minimize waste disposal expense and reduce the potential liability that comes with unnecessary handling of contaminated media, DWU should remove and dispose of as little contaminated waste as practical, which means invoking the "TRRP Utility Exclusion" whenever possible.

This exclusion is codified in the Texas Risk Reduction Program (TRRP), 30 TAC §350.36 (a), and states:

"...The excavation of soils containing COCs during construction activities...and the subsequent replacement of those soils into that same excavation shall not be considered to constitute relocation or reuse and shall not be subject to the provisions of this section."

This exclusion allows contaminated trench excavation material to be temporarily stockpiled adjacent to the excavation and subsequently returned to the trench excavation from whence it came after the utility is installed.

Even within the TRRP utility exclusion framework, DWU is still accountable for how it handles and manages contaminated material. ***For example, regardless of the TRRP Utility Exclusion, soils containing NAPL should never be replaced back into a utility excavation.*** Furthermore, most utility projects displace a certain quantity of soils due to placement of the utility and bedding materials, and these soils will likely require disposal at an approved off-site landfill. As a cost-saving measure, it is recommended that soils be managed in a way that results in the impacted soils being

returned to the utility trench. Refer to **Example Site Scenario 4 (Appendix F)** and the information in **Standard Soil & Groundwater Management Procedures (Appendix I)** for examples of standard protocols on properly managing and handling impacted soils and groundwater.

Construction Worker Health & Safety

In most situations, construction worker safety and reducing and/or preventing construction worker exposure to hazardous substances or toxic materials is the responsibility of each respective employer. DWU and the City of Dallas have this responsibility for DWU and City employees, but a majority of the work performed on large utility construction projects is performed by hired contractors.

> ***Important Note: DWU should never accept health and safety responsibility for a contractor's personnel, and should be formal and diligent in assuring contractors understand the health and safety risks and accept responsibility for their own employees.***

During construction within a designated Affected Zone, environmental safety precautions should be followed that are protective of: 1) the general public; 2) DWU employees; 3) DWU's consultant's employees; and 4) DWU's contractor's and subcontractor's employees.

The Contractor and subcontractors should be responsible for reviewing environmental information provided in the **Project-Specific Soil and Groundwater Management Plan (Project-Specific SGMP)** (see Section 6.0) and developing their own appropriate Health and Safety Plans (HASPs) outlining project hazards, worker precautions, and specific contaminant-related hazards for their respective employees. If DWU personnel will be in the Affected Zone on the project site, DWU will also need to prepare a HASP for work at the site specifically for DWU employees. Refer to **Appendix J** for detailed information on health and safety considerations.

6.0 PROJECT-SPECIFIC SGMP REQUEST/REVIEW PROCESS

A copy of the **DWU Site Summary Document (Appendix D)** and **Project-Specific SGMP Contents Checklist (Appendix E)** shall be provided to an approved Environmental Consultant along with a request that the consultant prepare the Project-Specific SGMP. This plan should be completed prior to the bidding phase of the project so that it can be included with the pre-bid or request-for-proposal (RFP) package submitted to the contractors.

DWU project personnel should review the Project-Specific SGMP upon receipt of the plan from the Environmental Consultant. The plan should be reviewed to confirm the items in the Project-Specific SGMP Contents Checklist are included, and to review the general adequacy of the proposed soil and groundwater management procedures outlined in the plan. Refer to **Appendix I** for standard SGMP procedures.

In summary, the Project-Specific SGMP provided by the Environmental Consultant should include the following information:

- Procedures for excavation monitoring and field screening of environmental media to confirm the degree of contamination observed during construction is consistent with that observed during previous investigations;
- Procedures for handling, staging, characterizing, and profiling of impacted soils and/or groundwater from the Affected Zone;
- The proper waste classification (e.g., Class I or Class II) for soils and/or groundwater based on the available analytical data;
- If additional sampling data are required for waste characterization, a detailed waste characterization sampling plan including the number of samples, specific chemical analyses, and waste profiling procedures;
- Estimate of the volume of impacted soils and/or groundwater requiring off-site disposal;
- Procedures for transport and disposal of impacted soil and/or groundwater generated from the Affected Zone during construction activities;
- Name of landfill or receiving facility anticipated to receive impacted soils;
- Planned method of treatment, discharge, and/or disposal of impacted groundwater or surface water anticipated to be generated during excavation dewatering, and the name of the associated receiving facilities;
- Site map clearly depicting the Affected Zone and location of affected soils and/or groundwater;
- Proper decontamination procedures for project equipment (including earth-moving equipment), tools, materials, and personal protective equipment (PPE);
- A list of project contacts and procedures for communication of site findings if unanticipated conditions are encountered;
- Procedures for addressing unanticipated conditions or impacted areas;
- Special procedures for handling, transport, and disposal of Hazardous soils and/or groundwater if encountered; and
- Summary of work site physical and chemical hazards that may be encountered in the Affected Zone, as well as a clear statement that the contractor(s) are responsible for preparing their own project-specific HASPs to ensure the health and safety of their employees.

After review, copies of the Project-Specific SGMP should be provided by DWU to the contractor involved in portions of the project that involve handling or managing impacted environmental media in the Affected Zone.

7.0 PROJECT-SPECIFIC SGMP IMPLEMENTATION

The best time to communicate soil and groundwater management requirements to a contractor is typically during the pre-bid or RFP stage. A copy of the **Project-Specific SGMP** should be provided in the pre-bid package or RFP submitted to the contractor, and it should be clearly stated that the contractor is expected to review the Project-Specific SGMP and include the necessary labor, equipment, materials, permits, and waste treatment, transport, and disposal fees to properly implement the Project-Specific SGMP. Specific pay items applicable to implementation of the Project-Specific SGMP should also be provided to the contractors at this time. Refer to **Appendix L** for a copy of the applicable pay items.

Prior to the initiation of work, DWU should request copies of the HASPs prepared by the contractor and their subcontractors in response to the Project Specific SGMP. Copies of these HASPs should also be maintained within the DWU project file.

DWU should also retain an approved Environmental Consultant to ensure the Project-Specific SGMP is properly implemented and to conduct the following activities in accordance with the Project-Specific SGMP:

- Excavation monitoring and field screening of environmental media;
- Collection and analysis of soil and/or water samples;
- Waste characterization and profiling;
- Signing waste management documents on the behalf of DWU (with prior authorization); and
- Conducting oversight of contractor's soil and groundwater handling and staging procedures within the Affected Zone.

After work begins, DWU personnel (field inspectors and/or project managers) are encouraged to conduct periodic oversight of project work within the Affected Zone to ensure the contractor and subcontractors are following the guidelines established in the Project-Specific SGMP. The degree of DWU oversight will vary based on the nature and sensitivity of the project and the degree of environmental impacts within the Affected Zone.

8.0 PROJECT-SPECIFIC SGMP DOCUMENTATION

DWU should maintain copies of all waste profiles, manifests, and bills of lading associated with the off-site transport and disposal of impacted soils and/or groundwater. DWU should also request a summary of quantities of impacted soil and/or groundwater disposed at approved off-site facilities. For sensitive projects, a formal written summary report documenting field screening activities and the management and disposal of impacted soils and/or groundwater should be requested from the Environmental Consultant overseeing implementation of the Project-Specific SGMP. Copies of the report should be maintained within the DWU project file.

9.0 PROTOCOL FOR ADDRESSING UNEXPECTED CONTAMINATION

This standard protocol manual outlines a process for evaluating and addressing environmental contamination beginning in the project planning phase; however, it is likely that DWU will unexpectedly encounter contaminated soils and/or groundwater during utility projects. The basic steps of this manual will still apply, but the process will begin with the completion of a Phase II ESA to characterize the Affected Zone.

What to do if unexpected contamination is encountered?

- The DWU field inspector should postpone work at the site and call the DWU project manager to notify them of the contamination.

- The DWU project manager should then contact an approved Environmental Consultant and then meet the consultant at the site to assess the situation. The Environmental Consultant will assess the situation based on field-screening data and submit initial samples of soil and/or groundwater for laboratory analysis. The analyzed COCs may vary based on the site conditions.

- The initial analytical results should be reviewed by the Environmental Consultant in comparison to the Low-High threshold values outlined in **Chart 1** and **Chart 2 (Appendix A)**. If COCs are detected at concentrations exceeding Low-High threshold values, it is likely that materials and design modifications will be warranted for the stretch of the utility in the Affected Zone.

- If review of the initial analytical results indicates materials and design modifications are warranted, retain the Environmental Consultant to conduct a Phase II ESA to define the limits of the Affected Zone.

- Once the Affected Zone is characterized, the Environmental Consultant and Design Consultant should review the analytical results for the Affected Zone using **Charts 1, 2, and 3 (Appendix A)** to select the appropriate alternative materials and design specifications for use in the Affected Zone.

- After the alternative materials and design specifications are selected, complete the **DWU Site Summary Document (Appendix D)** and request that the Environmental Consultant prepare a Project-Specific SGMP for work within the Affected Zone.

- Submit the Project-Specific SGMP to the contractor, arrange for change orders according to applicable pay-items **(Appendix L)** and proceed with soil and groundwater management activities within the Affected Zone.

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APPENDIX A

Chart 1 – Chemical of Concern (COC) Evaluation – Soils

Chart 2 – Chemical of Concern (COC) Evaluation – Groundwater

Chart 3 – Construction Materials and Design Selection Chart

Embedment Specification: Embedment Class "E-1" & "E-2" Landfill

Embedment Specification: Embedment Class "E-3" High Chemical of Concern Zone

Embedment Specification: Contaminated Soil/Groundwater Clay Cut-Off Dam

Chart 1: Chemical of Concern (COC) Evaluation - Soils

Establishing Low, High, and Unacceptable Contaminant Conditions for Utility Material Selection and Installation Specifications

CHEMICAL OF CONCERN (COC)[1]	LOW RANGE (mg/kg)			HIGH RANGE (mg/kg)			UNACCEPTABLE[5]		
	MINIMUM[2]	to	MAXIMUM[3]	MINIMUM[3]	to	MAXIMUM[4]	Presence of Observed or Anticipated Non-Aqueous Phase Liquid (NAPL)		
COMMON PETROLEUM HYDROCARBONS - BTEX/MTBE and other Volatile Organic Compounds (VOCs)									
Benzene	Detected	to	1.3E-02	> 1.3E-02	to	3.6E+02	> 3.6E+02	to	NAPL Observed
Toluene	Detected	to	4.1E+00	> 4.1E+00	to	1.8E+02	> 1.8E+02	to	NAPL Observed
Ethyl benzene	Detected	to	3.8E+00	> 3.8E+00	to	7.4E+01	> 7.4E+01	to	NAPL Observed
m,p-Xylenes	Detected	to	5.3E+01	> 5.3E+01	to	9.6E+01	> 9.6E+01	to	NAPL Observed
o-Xylenes	Detected	to	3.5E+01	> 3.5E+01	to	5.0E+01	> 5.0E+01	to	NAPL Observed
Xylenes, Total	Detected	to	6.1E+01	> 6.1E+01	to	9.7E+01	> 9.7E+01	to	NAPL Observed
MTBE (methyl tert-butyl ether)	Detected	to	3.1E-01	> 3.1E-01	to	4.9E+03	> 4.9E+03	to	NAPL Observed
Isopropylbenzene (Cumene)	Detected	to	1.7E+02	> 1.7E+02	to	2.8E+02	> 2.8E+02	to	NAPL Observed
Naphthalene	Detected	to	1.6E+01	> 1.6E+01	to	8.0E+01	> 8.0E+01	to	NAPL Observed
N-Butylbenzene	Detected	to	7.6E+01	> 7.6E+01	to	5.4E+01	> 5.4E+01	to	NAPL Observed
N-Propylbenzene	Detected	to	2.2E+01	> 2.2E+01	to	7.7E+01	> 7.7E+01	to	NAPL Observed
p-Isopropyltoluene (Cymene)	Detected	to	1.2E+02	> 1.2E+02	to	6.5E+01	> 6.5E+01	to	NAPL Observed
Sec-Butylbenzene	Detected	to	4.2E+01	> 4.2E+01	to	6.3E+01	> 6.3E+01	to	NAPL Observed
Tert-Butylbenzene	Detected	to	5.0E+01	> 5.0E+01	to	6.2E+01	> 6.2E+01	to	NAPL Observed
Trimethylbenzene, 1,2,4-	Detected	to	2.4E+01	> 2.4E+01	to	1.6E+03	> 1.6E+03	to	NAPL Observed
Trimethylbenzene, 1,3,5-	Detected	to	2.7E+01	> 2.7E+01	to	1.7E+03	> 1.7E+03	to	NAPL Observed
COMMON PETROLEUM HYDROCARBONS - Polycyclic Aromatic Hydrocarbons (PAHs)									
Acenaphthene	Detected	to	1.2E+02	> 1.2E+02	to	1.2E+05	> 1.2E+05	to	NAPL Observed
Acenaphthylene	Detected	to	2.0E+02	> 2.0E+02	to	2.0E+05	> 2.0E+05	to	NAPL Observed
Anthracene	Detected	to	3.4E+03	> 3.4E+03	to	3.4E+06	> 3.4E+06	to	NAPL Observed
Benz-a-anthracene	Detected	to	5.6E+00	> 5.6E+00	to	5.6E+03	> 5.6E+03	to	NAPL Observed
Benzo-a-pyrene	Detected	to	5.6E-01	> 5.6E-01	to	5.6E+02	> 5.6E+02	to	NAPL Observed
Benzo-b-fluoranthene	Detected	to	5.7E+00	> 5.7E+00	to	5.7E+03	> 5.7E+03	to	NAPL Observed
Benzo-g,h,i-perylene	Detected	to	1.8E+03	> 1.8E+03	to	1.8E+06	> 1.8E+06	to	NAPL Observed
Benzo-k-fluoranthene	Detected	to	5.7E+01	> 5.7E+01	to	5.7E+04	> 5.7E+04	to	NAPL Observed
Chrysene	Detected	to	5.6E+02	> 5.6E+02	to	5.6E+05	> 5.6E+05	to	NAPL Observed
Dibenz-a,h-anthracene	Detected	to	5.5E-01	> 5.5E-01	to	5.5E+02	> 5.5E+02	to	NAPL Observed
Dibenzofuran	Detected	to	1.7E+01	> 1.7E+01	to	1.7E+04	> 1.7E+04	to	NAPL Observed
Fluoranthene	Detected	to	9.6E+02	> 9.6E+02	to	9.6E+05	> 9.6E+05	to	NAPL Observed
Fluorene	Detected	to	1.5E+02	> 1.5E+02	to	1.5E+05	> 1.5E+05	to	NAPL Observed
Indeno-1,2,3-cd-pyrene	Detected	to	5.7E+00	> 5.7E+00	to	5.7E+03	> 5.7E+03	to	NAPL Observed
Phenanthrene	Detected	to	2.1E+02	> 2.1E+02	to	2.1E+05	> 2.1E+05	to	NAPL Observed
Pyrene	Detected	to	5.6E+02	> 5.6E+02	to	5.6E+05	> 5.6E+05	to	NAPL Observed
COMMON PETROLEUM HYDROCARBONS - Total Petroleum Hydrocarbons (TPH)									
TPH C6 - C12 (gasoline range)	Detected	to	3.3E+01	> 3.3E+01	to	1.0E+04	> 1.0E+04	to	NAPL Observed
TPH C12 - C28 (diesel range)	Detected	to	9.9E+01	> 9.9E+01	to	1.0E+04	> 1.0E+04	to	NAPL Observed
TPH C28 - C35 (oil range)	Detected	to	9.9E+01	> 9.9E+01	to	1.0E+04	> 1.0E+04	to	NAPL Observed
COMMON KETONES									
Acetone (2-propanone)	Detected	to	2.1E+01	> 2.1E+01	to	4.7E+04	> 4.7E+04	to	NAPL Observed
Methyl ethyl ketone (2-butanone)	Detected	to	1.5E+01	> 1.5E+01	to	1.9E+04	> 1.9E+04	to	NAPL Observed
Methyl isobutyl ketone (4-methyl-2-pentanone)	Detected	to	2.5E+00	> 2.5E+00	to	1.9E+03	> 1.9E+03	to	NAPL Observed

FOOTNOTES:

1. Chart 1 includes common COCs anticipated to be encountered on DWU projects. Low-High threshold values for COCs not included on this chart can be obtained by using the Texas Commission on Environmental Quality (TCEQ) Texas Risk Reduction Progam (TRRP) Tier 1 Critical Protective Concentration Levels (PCLs) for Residential Land Use and a 30-Acre source area (see footnote 3 below).

2. COC is *detected* at a concentration exceeding the analytical laboratory detection/reporting limit.

3. Concentrations for differentiating between Low and High contaminant conditions are based on the TCEQ TRRP Tier 1 Critical PCLs for Residential Land Use and a 30-Acre Source Area.

4. Soil concentrations for organic compounds that suggest the possible presence of NAPL: a) values for organic compounds with the exception of PAHs and TPH are equal to 80% of the Theoretical Soil Saturation Concentration (Csat) using TRRP equations and Tier 1 default values for soil and chemical properties; b) due to the low solubility of PAHs and the fact the PAH NAPL is not anticipated, values for PAHs were derived by multiplying the Tier 1 Critical PCL by a factor of 1,000 to provide numerical reference values; c) values for TPH are equal to the Residual Soil Saturation Limit ($Soil_{Res}$) using TRRP equations and default soil and chemical properties; and d) values for metals were calculated by multiplying the Tier 1 Critical PCL by a factor of 1,000 to provide numerical reference values. In reality, the presence of NAPL or these metals in free-phase is unlikley to occur on DWU projects.

5. The observed or anticipated presence of NAPL indicates an Unacceptable Contaminant Condition. Options for addressing Unacceptable Contaminant Conditions include: a) removal or remediation of the NAPL prior to construction; b) relocation of the project or modification of the design to avoid the zone affected by NAPL; or c) and in-depth site-specific evaluation by an Environmental Consultant to evaluate the situation and present suitable options for proceeding with the project. The in-depth site-specific evaluation will generally be most useful when COC concentrations indicate the possible or likley presence of NAPL, but no NAPL is physically observed. Refer to pages 11 and 12 of the standard protocol manual for guidance on determining when NAPL is present.

ADDITIONAL NOTES:

- The above values are in scientific notation. For example, the benzene Low-High threshold value of 0.013 mg/kg is expressed as 1.3E-02.

- It should be noted that the above values are for use in evaluating the appropriate DWU utility materials and design specifications and are not intended for the evaluation of Construction Worker Health & Safety at the project site.

- *This document and* ***associated appendices are for use by DWU staff, consultants, and contractors on DWU-led and DWU-joint projects only. Use of, or reliance on, this document by outside parties for*** *non-DWU projects is* ***strictly prohibited.***

Chart 1: Chemical of Concern (COC) Evaluation - Soils

Establishing Low, High, and Unacceptable Contaminant Conditions for Utility Material Selection and Installation Specifications

CHEMICAL OF CONCERN (COC)[1]	LOW RANGE (mg/kg)			HIGH RANGE (mg/kg)			UNACCEPTABLE[5] Presence of Observed or Anticipated Non-Aqueous Phase Liquid (NAPL)
	MINIMUM[2]	to	MAXIMUM[3]	MINIMUM[3]	to	MAXIMUM[4]	
COMMON CHLORINATED VOLATILE ORGANIC COMPOUNDS (VOCs)							
Carbon tetrachloride	Detected	to	3.1E-02	> 3.1E-02	to	4.0E+02	> 4.0E+02 to NAPL Observed
Chlorobenzene	Detected	to	5.5E-01	> 5.5E-01	to	2.2E+02	> 2.2E+02 to NAPL Observed
Chlorethane	Detected	to	1.5E+01	> 1.5E+01	to	2.5E+03	> 2.5E+03 to NAPL Observed
Chloroform	Detected	to	5.1E-02	> 5.1E-02	to	1.7E+02	> 1.7E+02 to NAPL Observed
Chloromethane	Detected	to	2.0E-01	> 2.0E-01	to	1.7E+03	> 1.7E+03 to NAPL Observed
Dichlorobenzene, 1,2-	Detected	to	8.9E+00	> 8.9E+00	to	1.8E+02	> 1.8E+02 to NAPL Observed
Dichlorobenzene, 1,3-	Detected	to	3.4E+00	> 3.4E+00	to	4.0E+01	> 4.0E+01 to NAPL Observed
Dichlorobenzene, 1,4-	Detected	to	1.1E+00	> 1.1E+00	to	8.3E+01	> 8.3E+01 to NAPL Observed
Dichloroethane, 1,1-	Detected	to	9.2E+00	> 9.2E+00	to	8.3E+02	> 8.3E+02 to NAPL Observed
Dichloroethane, 1,2-	Detected	to	6.9E-03	> 6.9E-03	to	9.6E+02	> 9.6E+02 to NAPL Observed
Dichloroethene, 1,1-	Detected	to	2.5E-02	> 2.5E-02	to	6.9E+02	> 6.9E+02 to NAPL Observed
Dichloroethene, cis-1,2-	Detected	to	1.2E-01	> 1.2E-01	to	7.0E+02	> 7.0E+02 to NAPL Observed
Dichloroethene, trans-1,2-	Detected	to	2.5E-01	> 2.5E-01	to	1.2E+03	> 1.2E+03 to NAPL Observed
Methylene chloride (dichloromethane)	Detected	to	6.5E-03	> 6.5E-03	to	1.6E+03	> 1.6E+03 to NAPL Observed
Tetrachloroethane, 1,1,1,2-	Detected	to	7.1E-01	> 7.1E-01	to	1.8E+03	> 1.8E+03 to NAPL Observed
Tetrachloroethane, 1,1,2,2-	Detected	to	1.2E-02	> 1.2E-02	to	6.0E+02	> 6.0E+02 to NAPL Observed
Tetrachloroethylene (Perchloroethylene, Perc, or PCE)	Detected	to	2.5E-02	> 2.5E-02	to	8.0E+01	> 8.0E+01 to NAPL Observed
Trichloroethane, 1,1,1-	Detected	to	8.1E-01	> 8.1E-01	to	4.3E+02	> 4.3E+02 to NAPL Observed
Trichloroethane, 1,1,2-	Detected	to	1.0E-02	> 1.0E-02	to	7.1E+02	> 7.1E+02 to NAPL Observed
Trichloroethylene (TCE)	Detected	to	1.7E-02	> 1.7E-02	to	3.0E+02	> 3.0E+02 to NAPL Observed
Vinyl chloride	Detected	to	1.1E-02	> 1.1E-02	to	1.2E+03	> 1.2E+03 to NAPL Observed
COMMON METALS							
Antimony	Detected	to	2.7E+00	> 2.7E+00	to	2.7E+03	N/A - NAPL Not Anticipated
Arsenic	Detected	to	5.9E+00	> 5.9E+00	to	5.9E+03	N/A - NAPL Not Anticipated
Barium	Detected	to	2.2E+02	> 2.2E+02	to	2.2E+05	N/A - NAPL Not Anticipated
Beryllium	Detected	to	1.5E+00	> 1.5E+00	to	1.5E+03	N/A - NAPL Not Anticipated
Cadmium	Detected	to	7.5E-01	> 7.5E-01	to	7.5E+02	N/A - NAPL Not Anticipated
Chromium (total)	Detected	to	1.2E+03	> 1.2E+03	to	1.2E+06	N/A - NAPL Not Anticipated
Chromium (VI)	Detected	to	1.4E+01	> 1.4E+01	to	1.4E+04	N/A - NAPL Not Anticipated
Copper	Detected	to	5.2E+02	> 5.2E+02	to	5.2E+05	N/A - NAPL Not Anticipated
Lead (inorganic)	Detected	to	1.5E+01	> 1.5E+01	to	1.5E+04	N/A - NAPL Not Anticipated
Mercury	Detected	to	4.0E-02	> 4.0E-02	to	4.0E+01	N/A - NAPL Not Anticipated
Nickel and compounds	Detected	to	7.9E+01	> 7.9E+01	to	7.9E+04	N/A - NAPL Not Anticipated
Selenium	Detected	to	1.1E+00	> 1.1E+00	to	1.1E+03	N/A - NAPL Not Anticipated
Silver	Detected	to	2.4E-01	> 2.4E-01	to	2.4E+02	N/A - NAPL Not Anticipated
Thallium (& chloride compounds)	Detected	to	8.7E-01	> 8.7E-01	to	8.7E+02	N/A - NAPL Not Anticipated
Zinc	Detected	to	1.2E+03	> 1.2E+03	to	1.2E+06	N/A - NAPL Not Anticipated
MISCELLANEOUS CONTAMINANTS							
Bis(2-ethylhexyl)phthalate	Detected	to	4.3E+01	> 4.3E+01	to	3.2E+02	> 3.2E+02 to NAPL Observed
Pentachlorophenol	Detected	to	9.2E-03	> 9.2E-03	to	1.0E+01	> 1.0E+01 to NAPL Observed
Polychlorinated biphenyls (PCBs)	Detected	to	1.1E+00	> 1.1E+00	to	4.7E+01	> 4.7E+01 to NAPL Observed
Styrene	Detected	to	1.6E+00	> 1.6E+00	to	4.0E+02	> 4.0E+02 to NAPL Observed

FOOTNOTES:

1. Chart 1 includes common COCs anticipated to be encountered on DWU projects. Low-High threshold values for COCs not included on this chart can be obtained by using the Texas Commission on Environmental Quality (TCEQ) Texas Risk Reduction Progam (TRRP) Tier 1 Critical Protective Concentration Levels (PCLs) for Residential Land Use and a 30-Acre source area (see footnote 3 below).

2. COC is *detected* at a concentration exceeding the analytical laboratory detection/reporting limit.

3. Concentrations for differentiating between Low and High contaminant conditions are based on the TCEQ TRRP Tier 1 Critical PCLs for Residential Land Use and a 30-Acre Source Area.

4. Soil concentrations for organic compounds that suggest the possible presence of NAPL: a) values for organic compounds with the exception of PAHs and TPH are equal to 80% of the Theoretical Soil Saturation Concentration (Csat) using TRRP equations and Tier 1 default values for soil and chemical properties; b) due to the low solubility of PAHs and the fact the PAH NAPL is not anticipated, values for PAHs were derived by multiplying the Tier 1 Critical PCL by a factor of 1,000 to provide numerical reference values; c) values for TPH are equal to the Residual Soil Saturation Limit ($Soil_{Res}$) using TRRP equations and default soil and chemical properties; and d) values for metals were calculated by multiplying the Tier 1 Critical PCL by a factor of 1,000 to provide numerical reference values. In reality, the presence of NAPL or these metals in free-phase is unlikley to occur on DWU projects.

5. The observed or anticipated presence of NAPL indicates an Unacceptable Contaminant Condition. Options for addressing Unacceptable Contaminant Conditions include: a) removal or remediation of the NAPL prior to construction; b) relocation of the project or modification of the design to avoid the zone affected by NAPL; or c) and in-depth site-specific evaluation by an Environmental Consultant to evaluate the situation and present suitable options for proceeding with the project. The in-depth site-specific evaluation will generally be most useful when COC concentrations indicate the possible or likley presence of NAPL, but no NAPL is physically observed. Refer to pages 11 and 12 of the standard protocol manual for guidance on determining when NAPL is present.

ADDITIONAL NOTES:

- The above values are in scientific notation. For example, the benzene Low-High threshold value of 0.013 mg/kg is expressed as 1.3E-02.

- It should be noted that the above values are for use in evaluating the appropriate DWU utility materials and design specifications and are not intended for the evaluation of Construction Worker Health & Safety at the project site.

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Chart 2: Chemical of Concern (COC) Evaluation - Groundwater

Establishing Low, High, and Unacceptable Contaminant Conditions for Utility Material Selection and Installation Specifications

CHEMICAL OF CONCERN (COC)[1]	LOW RANGE (mg/L)			HIGH RANGE (mg/L)			UNACCEPTABLE[5] Presence of Observed or Anticipated Non-Aqueous Phase Liquid (NAPL)		
	MINIMUM[2]	to	MAXIMUM[3]	MINIMUM[3]	to	MAXIMUM[4]			
COMMON PETROLEUM HYDROCARBONS - BTEX/MTBE and other Volatile Organic Compounds (VOCs)									
Benzene	Detected	to	5.0E-03	> 5.0E-03	to	1.7E+01	> 1.7E+01	to	NAPL Observed
Toluene	Detected	to	1.0E+00	> 1.0E+00	to	2.1E+01	> 2.1E+01	to	NAPL Observed
Ethyl benzene	Detected	to	7.0E-01	> 7.0E-01	to	1.3E+00	> 1.3E+00	to	NAPL Observed
m,p-Xylenes	Detected	to	1.0E+01	> 1.0E+01	to	3.3E+00	> 3.3E+00	to	NAPL Observed
o-Xylenes	Detected	to	1.0E+01	> 1.0E+01	to	2.2E+00	> 2.2E+00	to	NAPL Observed
Xylenes, Total	Detected	to	1.0E+01	> 1.0E+01	to	7.9E+00	> 7.9E+00	to	NAPL Observed
MTBE (methyl tert-butyl ether)	Detected	to	2.4E-01	> 2.4E-01	to	5.8E+03	> 5.8E+03	to	NAPL Observed
Isopropylbenzene (Cumene)	Detected	to	2.4E+00	> 2.4E+00	to	4.0E+01	> 4.0E+01	to	NAPL Observed
Naphthalene	Detected	to	4.9E-01	> 4.9E-01	to	2.5E+01	> 2.5E+01	to	NAPL Observed
N-Butylbenzene	Detected	to	1.2E+00	> 1.2E+00	to	8.6E+00	> 8.6E+00	to	NAPL Observed
N-Propylbenzene	Detected	to	9.8E-01	> 9.8E-01	to	3.4E+01	> 3.4E+01	to	NAPL Observed
p-Isopropyltoluene (Cymene)	Detected	to	2.4E+00	> 2.4E+00	to	1.4E+01	> 1.4E+01	to	NAPL Observed
Sec-Butylbenzene	Detected	to	9.8E-01	> 9.8E-01	to	1.4E+01	> 1.4E+01	to	NAPL Observed
Tert-Butylbenzene	Detected	to	9.8E-01	> 9.8E-01	to	1.2E+01	> 1.2E+01	to	NAPL Observed
Trimethylbenzene, 1,2,4-	Detected	to	1.2E+00	> 1.2E+00	to	8.0E+02	> 8.0E+02	to	NAPL Observed
Trimethylbenzene, 1,3,5-	Detected	to	1.2E+00	> 1.2E+00	to	8.0E+02	> 8.0E+02	to	NAPL Observed
COMMON PETROLEUM HYDROCARBONS - Polycyclic Aromatic Hydrocarbons (PAHs)									
Acenaphthene	Detected	to	1.5E+00	> 1.5E+00	to	1.5E+03	> 1.5E+03	to	NAPL Observed
Acenaphthylene	Detected	to	1.5E+00	> 1.5E+00	to	1.5E+03	> 1.5E+03	to	NAPL Observed
Anthracene	Detected	to	7.3E+00	> 7.3E+00	to	7.3E+03	> 7.3E+03	to	NAPL Observed
Benz-a-anthracene	Detected	to	1.3E-03	> 1.3E-03	to	1.3E+00	> 1.3E+00	to	NAPL Observed
Benzo-a-pyrene	Detected	to	2.0E-04	> 2.0E-04	to	2.0E-01	> 2.0E-01	to	NAPL Observed
Benzo-b-fluoranthene	Detected	to	1.3E-03	> 1.3E-03	to	1.3E+00	> 1.3E+00	to	NAPL Observed
Benzo-g,h,i-perylene	Detected	to	7.3E-01	> 7.3E-01	to	7.3E+02	> 7.3E+02	to	NAPL Observed
Benzo-k-fluoranthene	Detected	to	1.3E-02	> 1.3E-02	to	1.3E+01	> 1.3E+01	to	NAPL Observed
Chrysene	Detected	to	1.3E-01	> 1.3E-01	to	1.3E+02	> 1.3E+02	to	NAPL Observed
Dibenz-a,h-anthracene	Detected	to	2.0E-05	> 2.0E-05	to	2.0E-02	> 2.0E-02	to	NAPL Observed
Dibenzofuran	Detected	to	9.8E-02	> 9.8E-02	to	9.8E+01	> 9.8E+01	to	NAPL Observed
Fluoranthene	Detected	to	9.8E-01	> 9.8E-01	to	9.8E+02	> 9.8E+02	to	NAPL Observed
Fluorene	Detected	to	9.8E-01	> 9.8E-01	to	9.8E+02	> 9.8E+02	to	NAPL Observed
Indeno-1,2,3-cd-pyrene	Detected	to	1.3E-03	> 1.3E-03	to	1.3E+00	> 1.3E+00	to	NAPL Observed
Phenanthrene	Detected	to	7.3E-01	> 7.3E-01	to	7.3E+02	> 7.3E+02	to	NAPL Observed
Pyrene	Detected	to	7.3E-01	> 7.3E-01	to	7.3E+02	> 7.3E+02	to	NAPL Observed
COMMON PETROLEUM HYDROCARBONS - Total Petroleum Hydrocarbons (TPH)									
TPH C6 - C12 (gasoline range)	Detected	to	9.8E-01	> 9.8E-01	to	5.2E+01	> 5.2E+01	to	NAPL Observed
TPH C12 - C28 (diesel range)	Detected	to	9.8E-01	> 7.3E-01	to	4.6E+00	> 4.6E+00	to	NAPL Observed
TPH C28 - C35 (oil range)	Detected	to	9.8E-01	> 1.3E+01	to	4.6E+00	> 4.6E+00	to	NAPL Observed
COMMON KETONES									
Acetone (2-propanone)	Detected	to	2.2E+01	> 2.2E+01	to	4.8E+05	> 4.8E+05	to	NAPL Observed
Methyl ethyl ketone (2-butanone)	Detected	to	1.5E+01	> 1.5E+01	to	1.9E+05	> 1.9E+05	to	NAPL Observed
Methyl isobutyl ketone (4-methyl-2-pentanone)	Detected	to	2.0E+00	> 2.0E+00	to	1.5E+04	> 1.5E+04	to	NAPL Observed

FOOTNOTES:

1. Chart 2 includes common COCs anticipated to be encountered on DWU projects. Low-High threshold values for COCs not included on this chart can be obtained by using the Texas Commission on Environmental Quality (TCEQ) Texas Risk Reduction Program (TRRP) Tier 1 Critical Protective Concentration Levels (PCLs) for Residential Land Use and a 30-Acre Source Area (see footnote 3 below).

2. COC is *detected* at a concentration exceeding the analytical laboratory detection/reporting limit.

3. Concentrations for differentiating between Low and High contaminant conditions are based on the TCEQ TRRP Tier 1 Critical PCLs for Residential Land Use and a 30-Acre Source Area.

4. Dissolved-phase concentrations for organic compounds that suggest presence of NAPL: a) values for BTEX/MTBE were derived from the EPA Effective Solubility Calculator (reference located in Appendix M) assuming released substance is 87 octane gasoline with MTBE; b) due to the low solubility of PAHs, concentrations of which are lower than the Tier 1 Critical PCL in many cases, values for PAHs were derived by multiplying the Tier 1 Critical PCL by a factor of 1,000 to provide numerical reference values; c) values for other organic compounds are equal to 80% of the solubility limits published in the TRRP Chemical/Physical Properties table (reference located in Appendix M); and d) values for metals were calculated by multiplying the Tier 1 Critical PCL by a factor of 1,000 to provide numerical reference values. In reality, the presence of NAPL or these metals in free-phase is unlikley to occur on DWU projects.

5. The observed or anticipated presence of NAPL indicates an Unacceptable Contaminant Condition. Options for addressing Unacceptable Contaminant Conditions include: a) removal or remediation of the NAPL prior to construction; b) relocation of the project or modification of the design to avoid the zone affected by NAPL; or c) and in-depth site-specific evaluation by an Environmental Consultant to evaluate the situation and present suitable options for proceeding with the project. The in-depth site-specific evaluation will generally be most useful when COC concentrations indicate the possible or likley presence of NAPL, but no NAPL is physically observed. Refer to pages 11 and 12 of the standard protocol manual for guidance on determining when NAPL is present.

ADDITIONAL NOTES:

- The above values are in scientific notation. For example, the benzene Low-High threshold value of 0.005 mg/L is expressed as 5.0E-03.

- It should be noted that the above values are for use in evaluating the appropriate DWU utility materials and design specifications and are not intended for the evaluation of Construction Worker Health & Safety at the project site.

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Chart 2: Chemical of Concern (COC) Evaluation - Groundwater

Establishing Low, High, and Unacceptable Contaminant Conditions for Utility Material Selection and Installation Specifications

CHEMICAL OF CONCERN (COC)[1]	LOW RANGE (mg/L)			HIGH RANGE (mg/L)			UNACCEPTABLE[5] Presence of Observed or Anticipated Non-Aqueous Phase Liquid (NAPL)		
	MINIMUM[2]	to	MAXIMUM[3]	MINIMUM[3]	to	MAXIMUM[4]			
COMMON CHLORINATED VOLATILE ORGANIC COMPOUNDS (VOCs)									
Carbon tetrachloride	Detected	to	5.0E-03	> 5.0E-03	to	6.4E+02	> 6.4E+02	to	NAPL Observed
Chlorobenzene	Detected	to	1.0E-01	> 1.0E-01	to	4.0E+02	> 4.0E+02	to	NAPL Observed
Chlorethane	Detected	to	9.8E+00	> 9.8E+00	to	1.6E+04	> 1.6E+04	to	NAPL Observed
Chloroform	Detected	to	2.4E-01	> 2.4E-01	to	8.0E+02	> 8.0E+02	to	NAPL Observed
Chloromethane	Detected	to	7.0E-02	> 7.0E-02	to	5.8E+03	> 5.8E+03	to	NAPL Observed
Dichlorobenzene, 1,2-	Detected	to	6.0E-01	> 6.0E-01	to	1.2E+02	> 1.2E+02	to	NAPL Observed
Dichlorobenzene, 1,3-	Detected	to	7.3E-01	> 7.3E-01	to	8.8E+01	> 8.8E+01	to	NAPL Observed
Dichlorobenzene, 1,4-	Detected	to	7.5E-02	> 7.5E-02	to	5.9E+01	> 5.9E+01	to	NAPL Observed
Dichloroethane, 1,1-	Detected	to	4.9E+00	> 4.9E+00	to	4.4E+03	> 4.4E+03	to	NAPL Observed
Dichloroethane, 1,2-	Detected	to	5.0E-03	> 5.0E-03	to	7.0E+03	> 7.0E+03	to	NAPL Observed
Dichloroethene, 1,1-	Detected	to	7.0E-03	> 7.0E-03	to	1.9E+03	> 1.9E+03	to	NAPL Observed
Dichloroethene, cis-1,2-	Detected	to	7.0E-02	> 7.0E-02	to	3.9E+03	> 3.9E+03	to	NAPL Observed
Dichloroethene, trans-1,2-	Detected	to	1.0E-01	> 1.0E-01	to	5.0E+03	> 5.0E+03	to	NAPL Observed
Methylene chloride (dichloromethane)	Detected	to	5.0E-03	> 5.0E-03	to	1.2E+04	> 1.2E+04	to	NAPL Observed
Tetrachloroethane, 1,1,1,2-	Detected	to	3.5E-02	> 3.5E-02	to	8.8E+02	> 8.8E+02	to	NAPL Observed
Tetrachloroethane, 1,1,2,2-	Detected	to	4.6E-03	> 4.6E-03	to	2.4E+03	> 2.4E+03	to	NAPL Observed
Tetrachloroethylene (Perchloroethylene, Perc, or PCE)	Detected	to	5.0E-03	> 5.0E-03	to	1.6E+02	> 1.6E+02	to	NAPL Observed
Trichloroethane, 1,1,1-	Detected	to	2.0E-01	> 2.0E-01	to	1.1E+03	> 1.1E+03	to	NAPL Observed
Trichloroethane, 1,1,2-	Detected	to	5.0E-03	> 5.0E-03	to	3.5E+03	> 3.5E+03	to	NAPL Observed
Trichloroethylene (TCE)	Detected	to	5.0E-03	> 5.0E-03	to	8.8E+02	> 8.8E+02	to	NAPL Observed
Vinyl chloride	Detected	to	2.0E-03	> 2.0E-03	to	2.2E+03	> 2.2E+03	to	NAPL Observed
COMMON METALS									
Antimony	Detected	to	6.0E-03	> 6.0E-03	to	6.0E+00	N/A - NAPL Not Anticipated		
Arsenic	Detected	to	1.0E-02	> 1.0E-02	to	1.0E+01	N/A - NAPL Not Anticipated		
Barium	Detected	to	2.0E+00	> 2.0E+00	to	2.0E+03	N/A - NAPL Not Anticipated		
Beryllium	Detected	to	4.0E-03	> 4.0E-03	to	4.0E+00	N/A - NAPL Not Anticipated		
Cadmium	Detected	to	5.0E-03	> 5.0E-03	to	5.0E+00	N/A - NAPL Not Anticipated		
Chromium (total)	Detected	to	1.0E-01	> 1.0E-01	to	1.0E+02	N/A - NAPL Not Anticipated		
Chromium (VI)	Detected	to	1.0E-01	> 1.0E-01	to	1.0E+02	N/A - NAPL Not Anticipated		
Copper	Detected	to	1.3E+00	> 1.3E+00	to	1.3E+03	N/A - NAPL Not Anticipated		
Lead (inorganic)	Detected	to	1.5E-02	> 1.5E-02	to	1.5E+01	N/A - NAPL Not Anticipated		
Mercury	Detected	to	2.0E-03	> 2.0E-03	to	2.0E+00	N/A - NAPL Not Anticipated		
Nickel and compounds	Detected	to	4.9E-01	> 4.9E-01	to	4.9E+02	N/A - NAPL Not Anticipated		
Selenium	Detected	to	5.0E-02	> 5.0E-02	to	5.0E+01	N/A - NAPL Not Anticipated		
Silver	Detected	to	1.2E-01	> 1.2E-01	to	1.2E+02	N/A - NAPL Not Anticipated		
Thallium (& chloride compounds)	Detected	to	2.0E-03	> 2.0E-03	to	2.0E+00	N/A - NAPL Not Anticipated		
Zinc	Detected	to	7.3E+00	> 7.3E+00	to	7.3E+03	N/A - NAPL Not Anticipated		
MISCELLANEOUS CONTAMINANTS									
Bis(2-ethylhexyl)phthalate	Detected	to	6.0E-03	> 6.0E-03	to	2.4E-01	> 2.4E-01	to	NAPL Observed
Pentachlorophenol	Detected	to	1.0E-03	> 1.0E-03	to	1.1E+01	> 1.1E+01	to	NAPL Observed
Polychlorinated biphenyls (PCBs)	Detected	to	5.0E-04	> 5.0E-04	to	4.4E-02	> 4.4E-02	to	NAPL Observed
Styrene	Detected	to	1.0E-01	> 1.0E-01	to	2.5E+02	> 2.5E+02	to	NAPL Observed

FOOTNOTES:

1. Chart 2 includes common COCs anticipated to be encountered on DWU projects. Low-High threshold values for COCs not included on this chart can be obtained by using the Texas Commission on Environmental Quality (TCEQ) Texas Risk Reduction Program (TRRP) Tier 1 Critical Protective Concentration Levels (PCLs) for Residential Land Use and a 30-Acre Source Area (see footnote 3 below).

2. COC is *detected* at a concentration exceeding the analytical laboratory detection/reporting limit.

3. Concentrations for differentiating between Low and High contaminant conditions are based on the TCEQ TRRP Tier 1 Critical PCLs for Residential Land Use and a 30-Acre Source Area.

4. Dissolved-phase concentrations for organic compounds that suggest presence of NAPL: a) values for BTEX/MTBE were derived from the EPA Effective Solubility Calculator (reference located in Appendix M) assuming released substance is 87 octane gasoline with MTBE; b) due to the low solubility of PAHs, concentrations of which are lower than the Tier 1 Critical PCL in many cases, values for PAHs were derived by multiplying the Tier 1 Critical PCL by a factor of 1,000 to provide numerical reference values; c) values for other organic compounds are equal to 80% of the solubility limits published in the TRRP Chemical/Physical Properties table (reference located in Appendix M); and d) values for metals were calculated by multiplying the Tier 1 Critical PCL by a factor of 1,000 to provide numerical reference values. In reality, the presence of NAPL or these metals in free-phase is unlikley to occur on DWU projects.

5. The observed or anticipated presence of NAPL indicates an Unacceptable Contaminant Condition. Options for addressing Unacceptable Contaminant Conditions include: a) removal or remediation of the NAPL prior to construction; b) relocation of the project or modification of the design to avoid the zone affected by NAPL; or c) and in-depth site-specific evaluation by an Environmental Consultant to evaluate the situation and present suitable options for proceeding with the project. The in-depth site-specific evaluation will generally be most useful when COC concentrations indicate the possible or likley presence of NAPL, but no NAPL is physically observed. Refer to pages 11 and 12 of the standard protocol manual for guidance on determining when NAPL is present.

ADDITIONAL NOTES:

- The above values are in scientific notation. For example, the benzene Low-High threshold value of 0.005 mg/L is expressed as 5.0E-03.

- It should be noted that the above values are for use in evaluating the appropriate DWU utility materials and design specifications and are not intended for the evaluation of Construction Worker Health & Safety at the project site.

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CHART 3 - CONSTRUCTION MATERIALS AND DESIGN SELECTION CHART
(Refer to Charts 1 and 2 to establish Contaminant Condition)

How to use chart:

Step 1 *Refer to the Contaminant Condition (i.e., Low, High, or Unacceptable) designated by the Environmental Consultant for soil and, if applicable, groundwater.*
Step 2 *Select an appropriate pipe material for the Contaminant Condition using Section (A) of the below table.*
Step 3 *Select an appropriate gasket/connection/fitting material far the Contaminant Condition using Section (B) of the below table.*
Step 4 *Select appropriate options for other engineering controls for the Contaminant Condition using Section (C) of the below table.*
Step 5 *If clay cut-off dams (Section D) are being utilized, evaluate the site-specific conditions to determine the proper number and placement of the dams.*
Step 6 *If Design Consultant makes selections, confirm the materials and design selections with the DWU Project Manager taking into account the site-specific conditions and any sensitive receptors.*

		CONTAMINANT CONDITION[1]			COMMENTS
(A) Pipe Selection[4]		**Low**	**High**	**Unacceptable[2]**	
OPTION	**WATER**				
1	DUCTILE IRON (DI) - Class 52-54[6]	ACCEPTABLE	LIMITED USE[3]	NOT ALLOWED	Not recommended for High chlorinated solvents or ketones. Requires double polywrap[6].
2	PVC (C900)[7]	ACCEPTABLE	LIMITED USE[3]	NOT ALLOWED	Pipe not recommended for High chlorinated solvents or ketones.
3	PVC (C905)[7]	ACCEPTABLE	LIMITED USE[3]	NOT ALLOWED	Pipe not recommended for High chlorinated solvents or ketones.
4	RCCP-Bar Wrapped	ACCEPTABLE	LIMITED USE[3]	NOT ALLOWED	Not recommended for High chlorinated solvents or ketones.
5	PCCP-Lined or Embedded Cylinder	ACCEPTABLE	LIMITED USE[3]	NOT ALLOWED	Not recommended for High chlorinated solvents or ketones.
6	Steel	ACCEPTABLE	ACCEPTABLE	NOT ALLOWED	Acceptable for High Contaminant Condition for all chemicals of concern (COCs) if welded.
OPTION	**WASTEWATER**				
7	PVC (SDR 26 or SDR 35)[7]	ACCEPTABLE	LIMITED USE[3]	NOT ALLOWED	Pipe not recommended for High chlorinated solvents or ketones.
8	RTRP (ASTM D3262 or D3754)	ACCEPTABLE	LIMITED USE[3]	NOT ALLOWED	Pipe not recommended for High chlorinated solvents or ketones.
9	RCP (ASTM C76, C361)	ACCEPTABLE	NOT ALLOWED	NOT ALLOWED	
10	PCCP-Lined or Embedded Cylinder	ACCEPTABLE	LIMITED USE[3]	NOT ALLOWED	Not recommended for High chlorinated solvents or ketones.
11	VCT	NOT ALLOWED	NOT ALLOWED	NOT ALLOWED	Not recommended by DWU.
12	HDPE Pipe	ACCEPTABLE	LIMITED USE[3]	NOT ALLOWED	For use in wastewater pipe installation in landfills only. Pipe not recommended for High chlorinated solvents or ketones.
(B) Gaskets/Connections/Fittings[4]		**Low**	**High**	**Unacceptable[2]**	
OPTION	**GASKET**				
1	Red Rubber- Styrene-Butadiene (SBR) Gasket	NOT ALLOWED	NOT ALLOWED	NOT ALLOWED	Typical, ASTM F477
2	ABS- Acrylonitrile Butadiene Styrene Gasket	NOT ALLOWED	NOT ALLOWED	NOT ALLOWED	
3	Neoprene- (CR) Gasket	NOT ALLOWED	NOT ALLOWED	NOT ALLOWED	
4	Nitrile- (NBR) Gasket	ACCEPTABLE	LIMITED USE[3]	NOT ALLOWED	Gasket not recommended for High chlorinated solvents or ketones.
5	Viton- Fluoroelastomer (FKM) Gasket	NOT ALLOWED	NOT ALLOWED	NOT ALLOWED	Not recommended by DWU.
6	Silicone	NOT ALLOWED	NOT ALLOWED	NOT ALLOWED	
7	Polyurethane Gaskets (AE or EU)	NOT ALLOWED	NOT ALLOWED	NOT ALLOWED	DWU research is ongoing for potential use in future.
8	RAM- NEK® FR	ACCEPTABLE	LIMITED USE[3]	NOT ALLOWED	For use on **storm sewer only**. Not recommended for High chlorinated solvents or ketones.
9	PSX- Direct-Drive Nitrile	ACCEPTABLE	LIMITED USE[3]	NOT ALLOWED	Pipe to manhole application. Not recommended for High chlorinated solvents or ketones.
OPTION	**NON-GASKET**				
10	Certalock	ACCEPTABLE	NOT ALLOWED	NOT ALLOWED	For use on approved **water pipe only**. Not recommended for High chlorinated solvents or ketones.
11	Gasketless Technology (PVC Fusion)	ACCEPTABLE	LIMITED USE[3]	NOT ALLOWED	Not recommended for High chlorinated solvents or ketones.
12	Welded Steel	ACCEPTABLE	ACCEPTABLE	NOT ALLOWED	Welded steel is only option suitable for High chlorinated solvents or ketones[3].
(C) Other Engineering Controls[4,5]		**Low**	**High**	**Unacceptable[2]**	
OPTION	**EMBEDMENT/TRENCHLESS**				
1	Open Cut - DWU Standard Embement Spec.	ACCEPTABLE	NOT ALLOWED	NOT ALLOWED	DWU standard embedment specifications.
2	Open Cut - Trench E-1 (Landfill - Clean Zone)	ACCEPTABLE	ACCEPTABLE	NOT ALLOWED	For installation in landfills. Refer to Appendix A of manual.
3	Open Cut - Trench E-2 (Landfill - Trash Zone)	ACCEPTABLE	ACCEPTABLE	NOT ALLOWED	For installation in landfills. Refer to Appendix A of manual.
4	Open Cut - Trench E-3 (High Chemical of Concern Zone)	ACCEPTABLE	ACCEPTABLE	NOT ALLOWED	For use in High Contaminant Condition. Refer to Appendix A of manual.
5	Trenchless Installation (BOTOC)	ACCEPTABLE	ACCEPTABLE	NOT ALLOWED	Requires clay cut-off dam or similar method to mitigate preferential flow of contaminants.
(D) Mandatory Requirements[5]		**Low**	**High**	**Unacceptable[2]**	
Clay Cut-Off Dam		SITE-SPECIFIC	REQUIRED	NOT ALLOWED	Clay cut-off dams are required for all embedment specifications and engineering controls listed above in Section C for High Contaminant Conditions. The use of clay cut-off dams for Low Contaminant Conditions is to be evaluated based on site-specific conditions. DWU should also evaluate the site-specific conditions to determine the proper number and placement of the clay cut-off dams. DWU may request input from the Environmental Consultant regarding the number and placement of the clay dams if deemed warranted.

FOOTNOTES:

1. The Contaminant Condition is designated by the Environmental Consultant based on comparison of soil and/or groundwater analytical data to the Low, High, and Unacceptable Contaminant Condition values in Chart 1 and Chart 2 of this standard protocol manual.

2. The observed or anticipated presence of non-aqueous phase liquid (NAPL) indicates an Unacceptable Contaminant Condition. Options for addressing Unacceptable Contaminant Conditions include: a) removal or remediation of the NAPL prior to construction; b) relocation of the project or modification of the design to avoid the zone affected by NAPL; or c) an in-depth site-specific evaluation by an Environmental Consultant to evaluate the situation and present suitable options for proceeding with the project. The in-depth site-specific evaluation will generally be most useful when chemical of concern (COC) concentrations indicate the possible or likley presence of NAPL, but no NAPL is physically observed. Refer to pages 11 and 12 of the standard protocol manual for guidance on determining when NAPL is present.

3. LIMITED USE = The pipe and/or gasket selection is <u>not recommened for use with chlorinated solvents or ketones</u> (Refer to Chart 1 and Chart 2) present in the soils or groundwater at concentrations equaling a High Contaminant Condition. In addition, certain pipe materials (e.g., Ductile Iron, RCCP Bar-Wrapped, and PCCP-Lined or Embedded Cylinder) are suitable for use with chlorinated solvents or ketones equaling a High Contaminant Condition, but the use of these pipe materials is limited by the lack of suitable gaskets. The only suitable option for chlorinated solvents or ketones at concentrations equaling a High Contaminant Condition is welded steel.

4. The Design Consultant is responsible for determining and selecting pipe, gasket, and trench materials in accordance with primary design criteria and suitability for the subject Contaminant Condition according to this chart. Alternative material and design selections should be sought only after standard specifications are deemed unsuitable. The final selections are to be approved by the DWU Project Manager on a project-specific basis.

5. DWU reserves the right to modify engineering controls if embedment/trench and material selection are deemed potentially insufficient to minimize contact with the contaminant and/or control accelerated contaminant movement. For example, the presence of nearby sensitive receptors such as potable water supply wells or surface waters could drive the need for engineering controls beyond the embedment or trench specifications listed above.

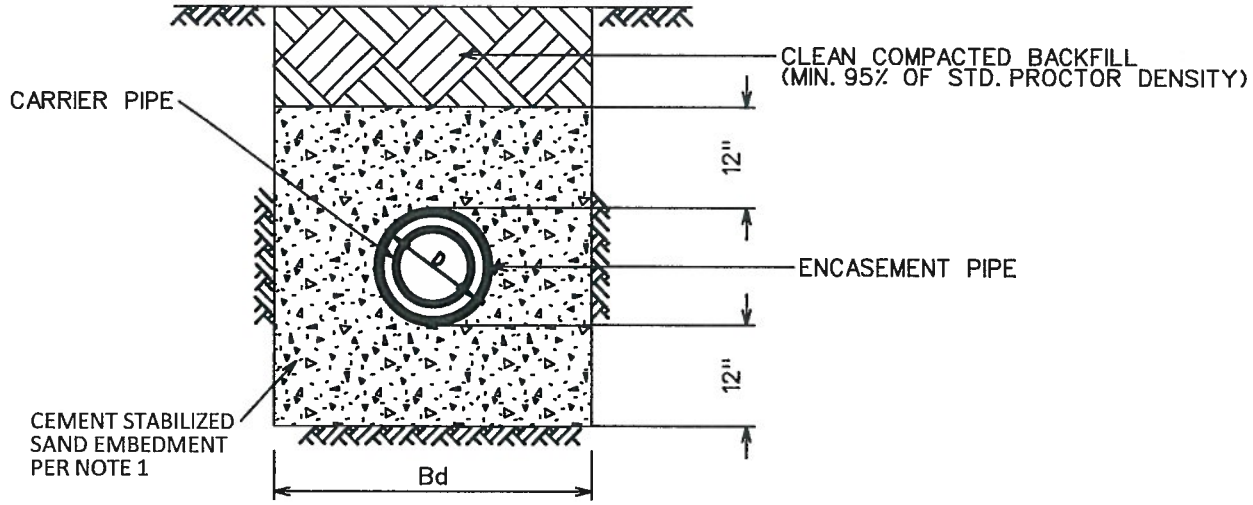
6. When using DI pipe, the use of two layers of polywrap is required. Use 8-mil "virgin polyethylene" polywrap as the inner layer (directly on the outside of the pipe) followed by a 4-mil "virgin polyethylene" polywrap as the outer layer. Only 100% "virgin polyethylene" will be accepted. No recycled polyethylene polywraps will be permitted.

7. All non-standard gaskets will have to be pre-manufactured into PVC pipe.

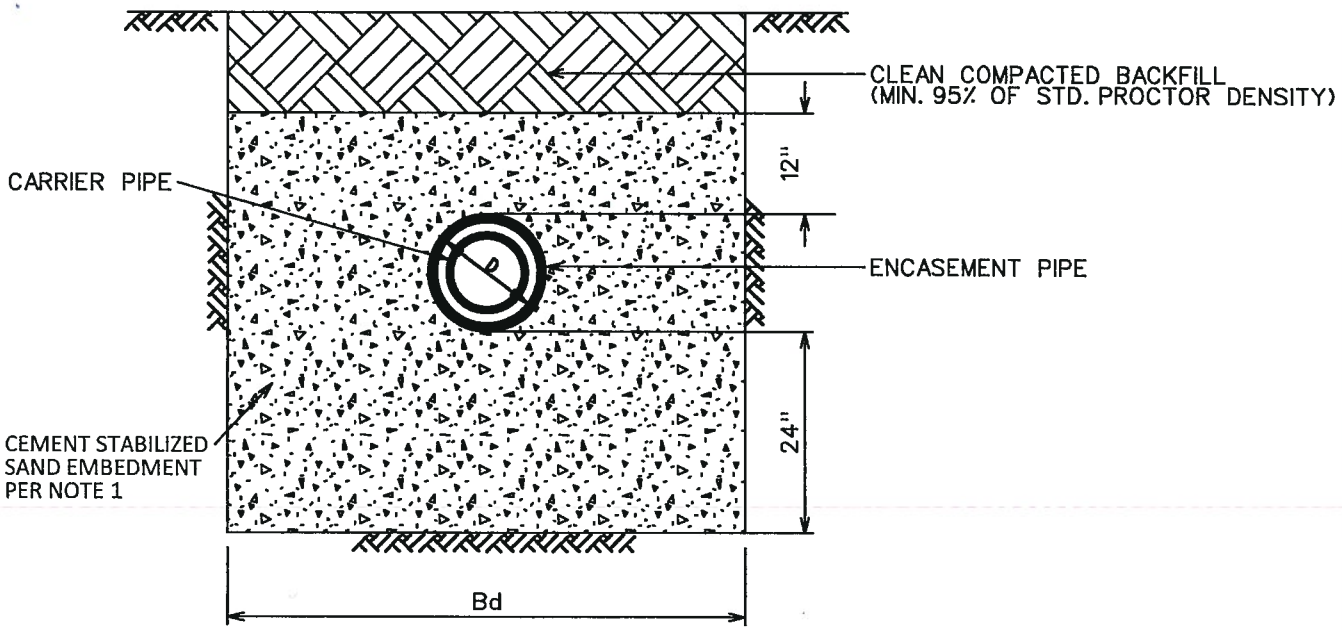
GENERAL NOTES:

-- Design and installation of utilities in contaminated areas (i.e., the Affected Zone) under all Contaminant Conditions (i.e., Low, High, and Unacceptable) should be implemented in accordance with a Project-Specific Soil and Groundwater Management Plan (SGMP) prepared by an Environmental Consultant specifically for the project and site-specific conditions.

-- Material and design selections will be updated regularly based on future information and technology. All recommendations in this chart are based on 2011 information and technology.



TRENCH E-1 (CLEAN ZONE)
CEMENT STABILIZED SAND EMBEDMENT

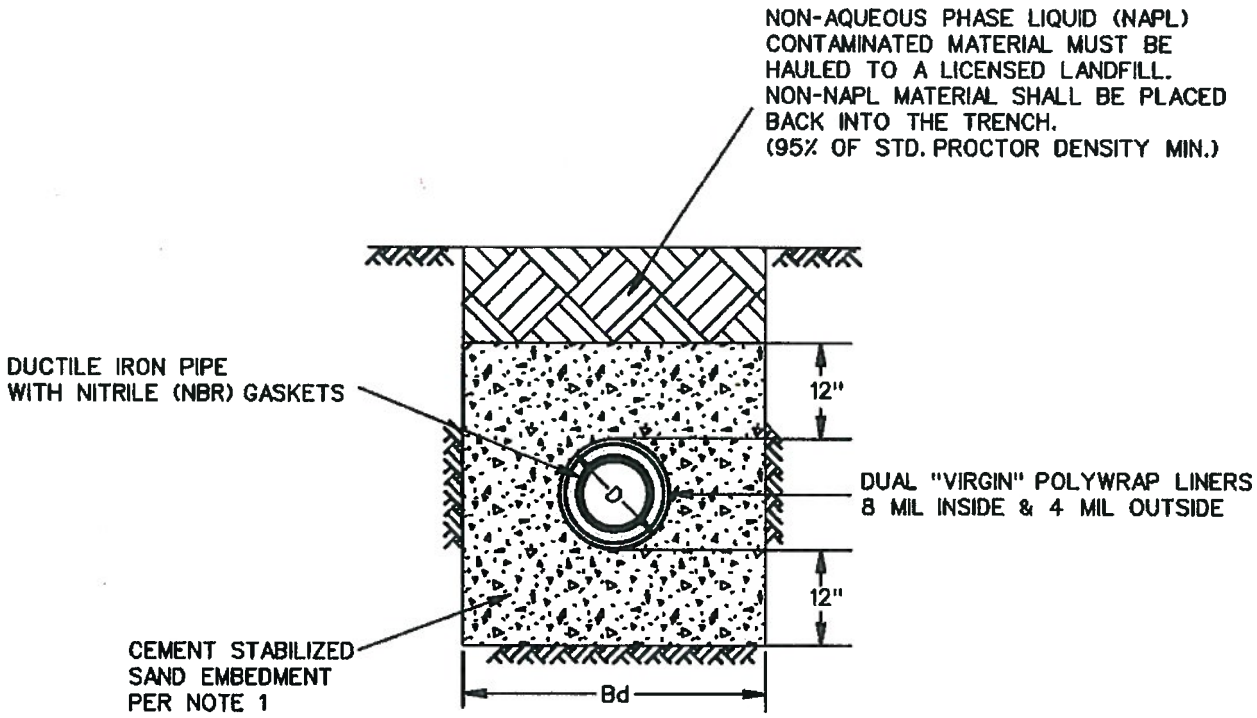


NOTES:
1. D = Inside Diameter of Containment Pipe
2. Bd = Trench Width Per Standard Drawing 112

TRENCH E-2 (TRASH ZONE)
CEMENT STABILIZED SAND EMBEDMENT

Note 1: Cement stabilized sand shall have a minimum of 12% cement per cubic yard of cement stabilized sand mixture, based on loose dry weight volume (at least 3 bags of cement per cubic yard of mixture).

EMBEDMENT CLASS "E-1" & "E-2" LANDFILL		DWU	XXX
		DATE OCT. 2011	

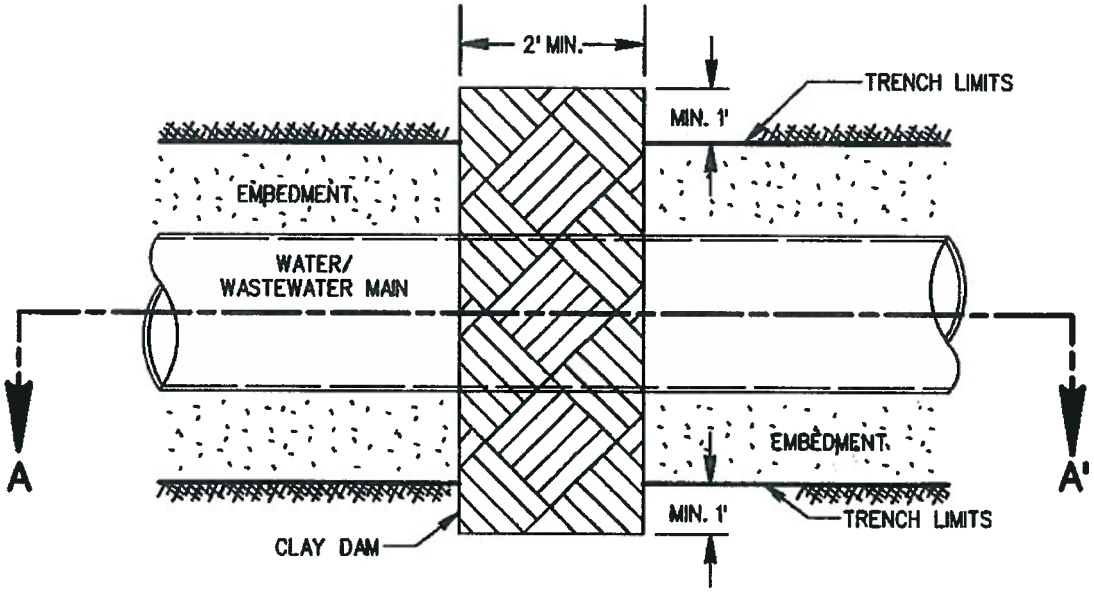


TRENCH E-3
"HIGH" CHEMICAL OF CONCERN ZONE

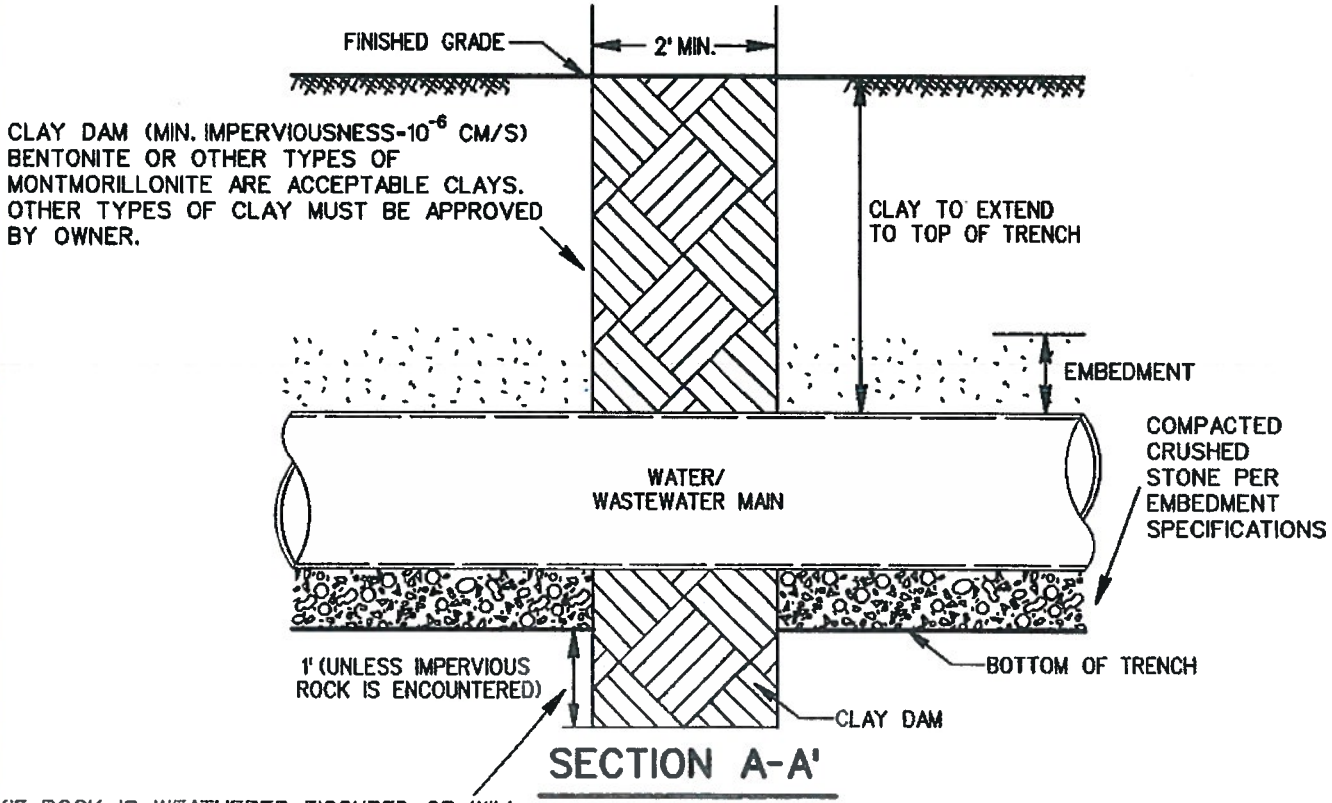
Note 1: Cement stabilized sand shall have a minimum of 12% cement per cubic yard of cement stabilized sand mixture, based on loose dry weight volume (at least 3.0 bags of cement per cubic yard of mixture). Minimum final permeability to be 10^{-6} cm/s.

EMBEDMENT CLASS "E-3" HIGH CHEMICAL OF CONCERN ZONE		DWU	119C
		OCT. 2011	

CLAY DAMS SHALL BE PLACED AT CONTAMINATION PLUME LIMITS TO PREVENT CONTAMINANT CONVEYANCE THROUGH UTILITY TRENCH. PLACEMENT AND LOCATION OF DAMS ARE SUBJECT TO DWU APPROVAL.



CLAY DAM PLAN VIEW



SECTION A-A'

(IF ROCK IS WEATHERED, FISSURED OR WILL TRANSPORT WATER, EXTRA DEPTH MAY BE REQUIRED)

REFER TO PAGES 112, 113, 114, 115, 116, 117, 118 & 119

CONTAMINATED SOIL CLAY CUT-OFF DAM		DWU	119A
		OCT. 2011	

dallas water utilities
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APPENDIX B

File Review/Site Screening Contents Checklist and Template

FILE REVIEW/SITE SCREENING CONTENTS CHECKLIST

DWU Standard Protocol for Soil and Groundwater Management on Construction Sites

Version 1: Prepared November 4, 2011

dallas water utilities
city of dallas

DWU Project Name / PID#: _____

DWU Project Manager: _____

Information to be provided by DWU to Environmental Consultant:

- ☐ Detailed project location including addresses, intersections, maps, and GIS coordinates as applicable
- ☐ Width of ROW, easement, or utility work area
- ☐ Proposed utility type
- ☐ Proposed utility depth and preliminary construction details if available
- ☐ Any known environmental information or reports, including any Areas of Concern from DWU GIS Database
- ☐ Anticipated project schedule and any other pertinent, project-specific details

Information to be provided by Environmental Consultant to DWU in the File Review/Site Screening Document:

- ☐ To-scale site location map depicting location of project and clearly depicting location of Areas of Concern (May require use of several maps for large linear projects)
- ☐ Review and summary of standard regulatory records sources for project and surrounding area within a 1,000-foot radius of the site
- ☐ Review and summary of EPA and/or TCEQ files for specific properties located proximate to the project that have the potential to be Areas of Concern
- ☐ Review and summary of standard historical records sources for project and nearby properties, including historic aerial photographs, topographic maps, sanborn maps, and city directories
- ☐ Review and summary of local records sources for project and nearby properties, including but not limited to the Office of Environmental Quality, Fire Department, Environmental and Health Services Department, and Building Records
- ☐ Summary of project area/site reconnaissance to identify evidence of any current or former environmental concerns or specific Areas of Concern
- ☐ Summary of Findings and Conclusions including:

  - If Areas of Concern were identified with respect to the project;
  - Whether there are existing data to properly characterize the Affected Zone(s) for the identified Areas of Concern;
  - If further assement and/or subsurface investigation are needed to properly characterize the Affected Zone(s);
  - Recommendations on the general scope for this assement and/or subsurface investigation;
  - **A determination on whether potential environmental concerns exist and whether a Phase II ESA is warranted to evaluate COCs at the site with respect to the project; and**
  - **If analytical data pertinent to the project are discovered during the file review, a professional opinion on whether the data are sufficient to adequately characterize the Affected Zone and preclude the need for additional investigation.**
  - If the analytical data are sufficient to characterize the Affected Zone, a designation of the contaminant condition as Low, High, or Unacceptable using Charts 1 and 2 of the Manual (further discussed in Section 3.0).

****Refer to attached suggested format for the File Review/Site Screening deliverable****

FILE REVIEW / SITE SCREENING – SUGGESTED FORMAT

[Date]

Dallas Water Utilities
[2121 Main Street, Suite 500]
[Dallas, Texas 75201]

Attn: [DWU Project Manager]
[Phone]
[Email]

Re: File Review / Site Screening (FRSS)
PID [####]
[Site Address]
Dallas, Dallas County, Texas
Consultant Project No. [XXXXX]

Dear Mr. [DWU Project Manager]:

[A-1 Environmental Consultants] is pleased to submit this File Review / Site Screening (FRSS) letter report for the above-referenced site. The FRSS was performed in accordance with [insert consultant proposal] and our professional services contract [insert applicable] with the City of Dallas.

Site Description

Provide detailed description of the site including the location, length, and width of the subject right-of-way (ROW) and the proposed depth of the utility pipe and excavation. Also include information on the current site use and a brief description of the surrounding property uses.

Historical Review

Summarize the conclusions of the historical records review, specifically outlining past uses of the site and surrounding properties that are of potential environmental concern for the utility project. For past uses that constitute environmental concerns, outline the rationale utilized for determining that they constitute concerns (e.g., proximity to the ROW, hazardous substances potentially used, term of operations, presumed groundwater gradient, etc.).

Aerial Photographs

Describe the past uses of the site and surrounding properties based on the historical aerial photographs reviewed. Highlight potential environmental concerns.

City Directories

Describe the past uses of the site and surrounding properties based on the city directories reviewed. Highlight potential environmental concerns.

Sanborn Maps

Describe the past uses of the site and surrounding properties based on the Sanborn maps reviewed. Highlight potential environmental concerns.

Topographic Maps

Describe the past uses of the site and surrounding properties based on the historical topographic maps reviewed. Highlight potential environmental concerns.

Regulatory Review

Summarize the conclusions of the regulatory records review, specifically outlining regulated facilities located on the site and/or surrounding properties that are of potential environmental concern for the utility project. Indicate the search radii utilized for the review and provide the name of the regulatory database company that conducted the review. Note that the maximum search distance for evaluation of environmental concerns for DWU utility projects has been designated as 1,000 feet from the site or ROW. For regulated facilities that constitute environmental concerns, outline the rationale utilized for determining that they constitute concerns (e.g., proximity to the ROW, documented release of hazardous substances, presumed groundwater gradient, etc.).

Site and Adjoining Property Reconnaissance

Briefly summarize the field reconnaissance of the site/ROW and adjoining properties. Note any specific environmental concerns noted during the reconnaissance and relate concerns to information retrieved during the historical and regulatory records reviews if applicable.

Findings and Recommendations

Clearly summarize the potential environmental concerns for the site/ROW and identify and summarize Areas of Concern for the utility project. The Areas of Concern should be clearly demarcated on a to-scale site plan that shows the boundaries of the site/ROW. If Areas of Concern were not identified, discuss the rationale utilized to make this determination.

(*Recall that rationale for identifying Areas of Concern will include consideration of the proximity of the environmental concern to the ROW and proposed utility, the proposed depth of the utility with respect to the groundwater table, and various other factors.*)

Discuss whether there are existing data to properly characterize the Affected Zone(s) for the identified Areas of Concern, or whether further assement and/or subsurface investigation are needed to properly characterize the Affected Zone(s).

If additional assessment and/or subsurface investigation are needed, provide recommendations on the general scope for the work.

If analytical data sufficient to characterize the Affected Zone are reviewed, provide a designation of the contaminant condition as Low, High, or Unacceptable using Charts 1 and 2 of the standard protocol manual (discussed in Section 3.0 of manual).

[Closing paragraph]

Sincerely,
[A-1 Environmental Consultants, Inc.]

Ace Geologist
Senior Associate

Ethyl J. Engineer
Principal

Attachments: To-Scale Site Plan Depicting Areas of Concern
Aerial Photographs
Sanborn Maps
Topographic Maps
Regulatory Database Search

dallas water utilities
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APPENDIX C

Phase II ESA Contents Checklist

PHASE II ESA CONTENTS CHECKLIST

DWU Standard Protocol for Soil and Groundwater Management on Construction Sites

Version 1: Prepared November 4, 2011

dallas water utilities
city of dallas

DWU Project Name / PID#: _____

DWU Project Manager: _____

Information to be provided by DWU to Environmental Consultant:

- ☐ Detailed project location including addresses, intersections, maps, and GIS coordinates as applicable
- ☐ Width of ROW, easement, or utility work area
- ☐ Proposed utility type
- ☐ Proposed utility depth and preliminary construction details if available
- ☐ Any known environmental information or reports, including any Areas of Concern from DWU GIS Database or File Review/Site Screening
- ☐ Anticipated project schedule and any other pertinent, project-specific details

Information to be provided by Environmental Consultant to DWU in the Phase II ESA:

- ☐ An investigation work scope specifically targeted to characterize affected soils and/or groundwater with respect to potential impacts to the proposed utility project;
- ☐ Collection and analysis of soil and groundwater samples (as applicable) in accordance with industry-standard protocol and applicable U.S. EPA and TCEQ analytical methods using an EPA- and TCEQ- accredited laboratory;
- ☐ To-scale site map(s) depicting the locations of the soil and/or groundwater samples collected, call-out boxes with soil and groundwater analytical results, the location of the proposed utility, and a clear depiction of the location and extent of the Affected Zone(s);
- ☐ A to-scale geologic cross-section depicting, as applicable, the different soil zones, the water table, the locations of the affected soil and/or groundwater, and the proposed utility;
- ☐ A professional opinion on whether the data and results have adequately characterized the Affected Zone(s) with respect to DWU project objectives;
- ☐ A professional opinion on whether non-aqueous phase liquid (NAPL) exists, or may have reasonable potential to exist based on the analytical data, in soils and/or groundwater at or near the project site;
- ☐ A designation of the contaminant condition as Low, High, or Unacceptable using Charts 1 and 2 of this Manual (further discussed in Section 3.0); and
- ☐ A professional opinion on the stability of the Affected Zone in soil and/or groundwater and whether there is a potential for the extent of the Affected Zone to change in the future and thus warrant special design considerations.

Important Notes on Reviewing Data Summary Tables:

- *Make note of the units that the data are presented in. Most environmental analytical data are presented in parts per million (ppm) or parts per billion (ppb). Concentrations presented in mg/kg (soil) and mg/L (groundwater) are equivalent to ppm, while concentrations presented in µg/kg (soil) and µg/L (water) are equivalent to ppb.*
- *Most consultants will compare data to the applicable TCEQ Risk-Based Action or Screening Levels. These include PST Action Levels (included in this scenario) or Texas Risk Reduction Program (TRRP) Tier 1 Critical Protective Concentration Levels (PCLs).*
- *Although the Low/High Contaminant Condition Threshold Values in Charts 1 and 2 (Appendix A) were derived from TRRP PCLs, it should be noted that PST Action Levels and TRRP PCLs provided by the consultant should not be used to evaluate data for materials and design specifications. This evaluation should be made using the Low/High Contaminant Condition Threshold Values in Charts 1 and 2, as further discussed below.*

The soil analytical results indicate soils within the ROW are affected by a release of petroleum hydrocarbons. The highest concentrations of contaminants were detected in the soil sample collected from monitoring well MW-2. Petroleum hydrocarbon contaminants were not detected in the soil samples collected from monitoring wells MW-1 or MW-4. The edges of the Affected Zone were estimated conservatively by the Environmental Consultant based on the analytical results and extended proximate to the sample locations exhibiting non-detect results (MW-1 and MW-4).

Table 2 – Groundwater Analytical Results

Sample ID	Benzene (mg/L)	Toluene (mg/L)	Ethylbenzene (mg/L)	Xylenes (mg/L)	MTBE (mg/L)
MW-1	ND	ND	ND	ND	ND
MW-2	**0.356**	0.732	0.373	1.09	**0.455**
MW-3	**0.012**	0.034	0.009	0.065	0.014
MW-4	ND	ND	ND	ND	ND
TCEQ PST Action Levels	**0.005**	**1**	**0.7**	**10**	**0.36**

TCEQ = Texas Commission on Environmental Quality
PST = Petroleum Storage Tank Program
Action Levels = Risk-based values for assessing releases through the TCEQ PST Program
ND = Constituent not detected above laboratory reporting limits
mg/L = milligrams per liter
Bolded values exceed the applicable TCEQ PST Action Level

The groundwater analytical results indicate shallow groundwater within the ROW is affected by a release of petroleum hydrocarbons. The highest concentrations of contaminants were detected in the groundwater sample collected from monitoring well MW-2. Petroleum hydrocarbon contaminants were not detected in the groundwater samples collected from monitoring wells MW-1 or MW-4. The edges of the Affected Zone were estimated conservatively by the Environmental Consultant based on the analytical results and extended proximate to the sample locations exhibiting non-detect results (MW-1 and MW-4). The Affected Zone for groundwater was similar to the one for the soils within the ROW.

> *Important Note: The extent of the Affected Zones for soil and groundwater may be different based on the site-specific conditions; however, for the sake of simplicity, it is recommended that the Affected Zone for a project include the extent for which soil **and/or** groundwater are affected. As noted in the manual, DWU should specifically request that the Phase II ESA report from the consultant include a site map that clearly demarcates the Affected Zone with respect to the utility project.*

Evaluation Process

Step 1 – Classifying Contaminant Condition: Low, High, or Unacceptable (Done by Environmental Consultant)

The Environmental Consultant compares the data from the Phase II ESA to the values in **Chart 1** and **Chart 2 (Appendix A)** to classify the contaminant condition.

Chart 1: Chemical of Concern (COC) Evaluation – Soils

The soil analytical data are compared to Chart 1. Benzene, toluene, ethylbenzene, xylenes, and MTBE were all detected above laboratory reporting limits in the soil samples collected from monitoring wells MW-2 and MW-3; therefore, each of these contaminants at least falls within the Low Contaminant Condition.

The benzene concentration of 0.757 mg/kg detected in soil from monitoring well MW-2 exceeds the Low-High threshold value of 0.013 mg/kg (denoted in scientific notation as 1.3E-02) for benzene on Chart 2. The detected benzene concentration of 0.757 mg/kg does not exceed the High-Unacceptable threshold value of 360 mg/kg and NAPL (i.e., free phase gasoline product) was not observed at this sample location during the Phase II ESA, so the level of contamination is below the High-Unacceptable threshold. Therefore, use of Chart 1 indicates the benzene concentration in soil from MW-2 represents a High Contaminant Condition.

The concentrations of MTBE detected in the soil samples from monitoring wells MW-2 and MW-3 (0.933 mg/kg and 0.332 mg/kg, respectively) also exceed the Low-High threshold value of 0.31

mg/kg for MTBE. These detected MTBE concentrations do not exceed the High-Unacceptable threshold value of 4,900 mg/kg and NAPL was not observed; therefore, the MTBE concentrations in soil from MW-2 and MW-3 also represent High Contaminant Conditions.

The concentrations of toluene, ethylbenzene, and xylenes detected in the soil samples collected from monitoring wells MW-2 and MW-3 were below the Low-High threshold values of 4.1 mg/kg, 3.8 mg/kg, and 61 mg/kg, respectively, for these constituents. Therefore, the detected concentrations of these constituents in soils from MW-2 and MW-3 represent Low Contaminant Conditions.

When evaluating the overall contaminant condition for the Affected Zone, benzene and MTBE are classified in the High Contaminant Condition for soils; therefore, the highest degree of contaminant condition (i.e., High) applies to the entire Affected Zone.

Chart 2: Chemical of Concern (COC) Evaluation – Groundwater

The groundwater analytical data are compared to Chart 2. Benzene, toluene, ethylbenzene, xylenes, and MTBE were all detected above laboratory reporting limits in the groundwater samples collected from monitoring wells MW-2 and MW-3; therefore, each of these contaminants at least falls within the Low Contaminant Condition.

The benzene concentrations of 0.356 mg/L and 0.012 mg/L detected in the groundwater samples from MW-2 and MW-3, respectively, exceed the Low-High threshold value of 0.005 mg/L (denoted in scientific notation as 5.0E-03) for benzene on Chart 2. These detected benzene concentrations do not exceed the High-Unacceptable threshold value of 24 mg/L for benzene and NAPL was not observed during the Phase II ESA; therefore, use of Chart 2 indicates the benzene concentrations in groundwater from MW-2 and MW-3 represents a High Contaminant Condition.

The concentration of MTBE detected in the groundwater sample from monitoring well MW-2 (0.455 mg/L) also exceeds the Low-High threshold value of 0.24 mg/L for MTBE. This detected MTBE concentration does not exceed the High-Unacceptable threshold value of 1,000 mg/L for MTBE and NAPL was not observed during the Phase II ESA; therefore, use of Chart 2 indicates the MTBE concentration in groundwater from MW-2 represents a High Contaminant Condition.

The concentrations of toluene, ethylbenzene, and xylenes detected in the groundwater samples collected from monitoring wells MW-2 and MW-3 were below the Low-High threshold values of 1 mg/L, 0.7 mg/L, and 10 mg/L, respectively, for these constituents. In addition, the concentration of MTBE detected in the groundwater sample collected from MW-3 was below the Low-High threshold value of 0.24 mg/L for MTBE; therefore, the detected concentrations of toluene, ethylbenezene, and xylenes in groundwater from MW-2 and MW-3, and the detected MTBE concentration in groundwater from MW-3 represent Low Contaminant Conditions.

When evaluating the overall contaminant condition for the Affected Zone, benzene and MTBE are classified in the High Contaminant Condition for groundwater; therefore, the highest degree of contaminant condition (i.e., High) applies to the entire Affected Zone.

Step 2 – Selecting Construction Materials and Design Specifications (Done by Design Consultant)

Evaluation of the soil and groundwater analytical data by the Environmental Consultant classified the contaminant condition as High in the Affected Zone at the site. This information is then utilized by the Design Consultant in conjunction with **Chart 3** to select appropriate materials and design specifications to be utilized in the Affected Zone for this contaminant condition.

Piping

The Design Consultant reviews Chart 3 to evaluate water pipe materials suitable for a High Contaminant Condition for benzene and MTBE. Chlorinated solvents were not detected in the soil or groundwater samples from the site. Review of Chart 3 indicates the following water pipe materials are deemed acceptable for a High Contaminant Condition for benzene and MTBE:

- Ductile iron;
- Polyvinyl chloride (PVC – C900 and C905);
- RCCP-Bar Wrapped;
- PCCP-Lined or Embedded Cylinder; and
- Steel.

Based on review of Chart 3 and other project design and cost considerations, the Design Consultant selects PVC as the water pipe material for use within the Affected Zone.

Gaskets/Connections/Fittings

Chart 3 indicates that nitrile-NBR gaskets are the only gaskets acceptable for a High Contaminant Condition for benzene and MTBE. Chlorinated solvents were not detected in the soil or groundwater samples from the site, so the use of nitrile-NBR gaskets is acceptable.

Based on review of Chart 3 and other project design and cost considerations, the Design Consultant selects nitrile gaskets for use within the Affected Zone. Gasketless technology was evaluated but not selected for the project based on engineering considerations.

Embedment Specification

The Design Consultant reviews Chart 3 to evaluate the embedment specification suitable for a High Contaminant Condition for benzene and MTBE. Review of Chart 3 indicates that Trench E-3 (High Chemical of Concern Zone) should be utilized for a High Contaminant Condition. Embedment specifications Trench E-1 and Trench E-2 do not apply since the project is not within a landfill. Review of Chart 3 also indicates that clay cut-off dams are required to be installed. Embedment specifications and a design specification for the clay dam are included in **Appendix A** of this manual.

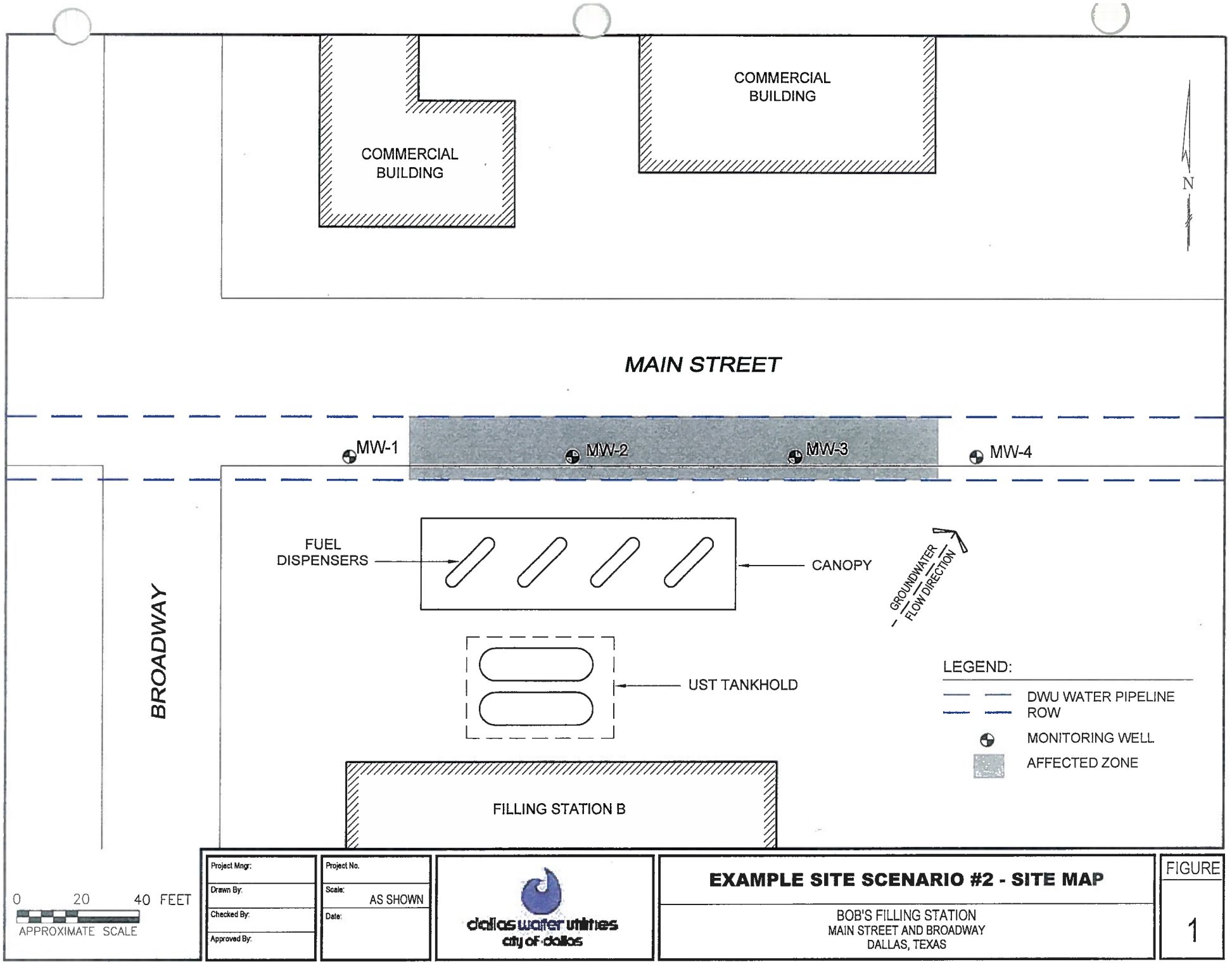
Based on review of Chart 3 and other project design and cost considerations, the Trench E-3 embedment specification with the addition of clay cut-off dams is selected for use within the Affected Zone. The Design Consultant and DWU contact the Environmental Consultant to provide input on the appropriate number and location of clay cut-off dams based on the site-specific conditions.

Shallow groundwater at the site is affected and will come into contact with the utility excavation and backfill. This affected groundwater may preferentially flow through the porous utility backfill material and accelerate the spread of the contamination. The low-permeability clay cut-off dams are designed to mitigate exacerbation of contamination by containing preferential flow in the porous backfill material to the Affected Zone.

> ***Important Note: The number and placement location of clay cut-off dams warranted for a given project will vary based on site-specific conditions. The Design Consultant and DWU should evaluate the site-specific conditions when selecting the number of clay dams and dam placement locations. DWU may contact an Environmental Consultant to evaluate the site conditions and provide input when deemed warranted.***

Conclusion

Review of analytical data from the Phase II ESA indicates that soil and groundwater within the ROW are affected by a release of petroleum hydrocarbons from Bob's Filling Station. The Environmental Consultant concludes that the data are adequate to sufficiently characterize the Affected Zone with respect to the utility project. Comparison of the analytical data to Charts 1 and 2 by the Environmental Consultant indicates that contaminants at the site, specifically benzene and MTBE, are present in soil and groundwater at levels equaling High Contaminant Conditions. The Design Consultant then utilizes Chart 3 to select the proper water pipe material, gasket material, and embedment specification for use within the Affected Zone for the High Contaminant Condition. In this case, these selections included PVC pipe, nitrile-NBR gaskets, and the Trench E-3 embedment specification with the addition of clay cut-off dams. The number and location of clay cut-off dams was determined by the Design Consultant and DWU with input from the Environmental Consultant.


COMMERCIAL BUILDING
COMMERCIAL BUILDING
N
MAIN STREET
MW-1
MW-2
MW-3
MW-4
FUEL DISPENSERS
CANOPY
GROUNDWATER FLOW DIRECTION
BROADWAY
UST TANKHOLD
LEGEND:
DWU WATER PIPELINE ROW
MONITORING WELL
AFFECTED ZONE
FILLING STATION B
0 20 40 FEET
APPROXIMATE SCALE
Project Mngr:
Drawn By:
Checked By:
Approved By:
Project No.
Scale: AS SHOWN
Date:
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EXAMPLE SITE SCENARIO #2 - SITE MAP
BOB'S FILLING STATION
MAIN STREET AND BROADWAY
DALLAS, TEXAS
FIGURE
1

Appendix F – Example Site Scenarios

SCENARIO 3 – Project-Specific Soil & Groundwater Management Plan (SGMP) and the Project RFP Process

Scenario

DWU is installing a water pipeline in the ROW adjacent to Bob's Filling Station. Previous evaluation of the project site (See Example Site Scenarios 1 and 2) indicated soil and groundwater along a section of the ROW are affected by the release of petroleum hydrocarbons. The Affected Zone was delineated, the contaminant condition for both soils and groundwater was classified as High, and appropriate piping material (PVC), gaskets (Nitrile-NBR), and embedment specifications (Trench E-3 with the addition of clay cut-off dams) were selected based on the High Contaminant Condition. DWU personnel are now prepared to proceed with the proposal and bidding stages for the project.

Example Process

Step 1 – Completion of the DWU Site Summary Document

The DWU project manager completes the **DWU Site Summary Document (Appendix D)** for the Affected Zone. Applicable portions, as noted on the document template, may alternatively be completed by the Environmental Consultant and Design Consultant. The completed DWU Site Summary Document is then provided to DWU personnel involved in the RFP preparation and project management process.

Step 2 – Completion/Submittal of the Project-Specific SGMP Contents Checklist

The DWU project manager completes the **Project-Specific SGMP Contents Checklist (See Appendix E)**. A copy of this checklist is then submitted, along with a copy of the DWU Site Summary Document, to an approved Environmental Consultant with a request to prepare the Project-Specific SGMP.

Step 3 – Review of the Project-Specific SGMP Prepared by Consultant

The DWU project manager reviews the Project-Specific SGMP prepared by the Environmental Consultant to ensure that the items on the checklist are all included. DWU then makes any comments it deems necessary to the Environmental Consultant and the Project-Specific SGMP is subsequently finalized.

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Step 4 – Preparation of the RFP/Bid Package

The DWU Site Summary Document and Project-Specific SGMP are provided as part of the RFP sent to general contractors that will be bidding on the project. Specific items included in the RFP pertaining to work within the Affected Zone are as follows:

- Statement that the contractor should be prepared to implement the Project-Specific SGMP for work conducted within the subject Affected Zone(s).
- Statement that the contractor should review the hazards summarized in the Project-Specific SGMP and should provide an appropriate Health & Safety Plan (HASP) for use by its employees during work conducted within the Affected Zone (the contractor is responsible for the health and safety of its employees).
- Statement that the contractor should inform all subcontractors that will be working within the Affected Zone of the site contaminant conditions so that these subcontractors can prepare accordingly and complete HASPs for their employees.
- Requests for line item and/or unit costs for Project-Specific SGMP items including:
    - handling and stockpiling of contaminated soils;
    - transport of contaminated soils to the selected landfill or receiving facility;
    - disposal of contaminated soils at the selected landfill or receiving facility;
    - handling and storing affected groundwater generated through trench dewatering;
    - treatment and/or disposal of affected groundwater into the sanitary or storm sewers and completion of applicable permits;
    - transport of contaminated groundwater to the selected receiving facility; and
    - disposal of contaminated groundwater at the selected receiving facility.
- A list of the specific piping, gasket, and embedment specifications for the site, the associated design plans, and any other variances from standard DWU specifications that are necessary in the Affected Zone due to the presence of contaminated media.

Conclusion

The project is awarded to the selected contractor, and the contractor is prepared for work within the Affected Zone. The contractor supplies a copy of its HASP to DWU for their records. Work on the project proceeds, and an Environmental Consultant contracted by DWU conducts oversight of the Project-Specific SGMP procedures as indicated in Section 7.0 of the standard protocol manual.

DWU Standard Protocol for Soil & Groundwater Management on Construction Sites

Appendix F – Example Site Scenarios

SCENARIO 4 – Soil & Groundwater Management in the Affected Zone (Bob's Filling Station)

Scenario

DWU is installing a municipal water pipeline in the ROW adjacent to Bob's Filling Station. Previous evaluation of the project site (See Example Site Scenarios 1 and 2) indicated soil and groundwater along a section of the ROW are affected by the release of petroleum hydrocarbons. The Affected Zone was delineated, the contaminant condition for both soils and groundwater was classified as High, and appropriate piping material (PVC), gaskets (Nitrile-NBR), and embedment specifications (Trench E-3 with the addition of clay cut-off dams) were selected based on the High Contaminant Condition. DWU contracted A1 Environmental Consultants to prepare the Project-Specific SGMP, and the Project-Specific SGMP was included in the RFP sent to the contractors. DFW Water Works was selected as the contractor to complete the work. DWU additionally contracted A1 Environmental Consultants to conduct project oversight and oversee the implementation of the Project-Specific SGMP.

A. Example Process – Landfill Pre-Approval for Soils

Step 1 – Review Findings of Project-Specific SGMP

The Project-Specific SGMP estimates that 250 cubic yards (cy) of Class 2 non-hazardous affected soils will be displaced by the utility installation and will require off-site disposal. It is also determines that the analytical data collected during the Phase II ESA will satisfy the landfill requirements for pre-approval.

Important Notes on Landfill Pre-Approval:

- *Landfill pre-approval is recommended to avoid project delays and improve efficiency. If the Environmental Consultant concludes that additional analytical data are needed for pre-approval when preparing the Project-Specific SGMP, they should outline a waste characterization sampling plan in the Project-Specific SGMP. The Environmental Consultant should then conduct this sampling and analysis prior to the beginning of the project so that the landfill pre-approval can be obtained using this data before work begins.*
- *If sufficient space for stockpiling and time are available, displaced affected soils to be disposed at a landfill may alternatively be stockpiled adjacent to a project and later sampled for waste characterization after the excavation in the Affected Zone is completed. In this process, composite soil samples are collected from the stockpiled soils after work is completed and are analyzed at the laboratory. The results are then utilized to characterize the waste and obtain the landfill approval.*

Step 2 – Completion of Landfill Approval Process

The Environmental Consultant completes the landfill profile and associated approval paperwork utilizing the Phase II ESA data and waste characterization and profiling procedures outlined in the Project-Specific SGMP. The landfill grants approval for 250 cy of Class 2 non-hazardous soils and provides pre-printed manifests to the Environmental Consultant.

B. Example Process – Utility Installation and Soil Management

Step 1 – Excavation Monitoring and Soil Screening Process

The contractor begins excavation of the utility trench in the ROW adjacent to Bob's filling station. Excavated soils are placed on top of plastic sheeting adjacent to the ROW during excavation. The soils are field-screened by the DWU-contracted Environmental Consultant in accordance with the Project-Specific SGMP through use of sensory observations (i.e., odors and staining) and photoionization detector (PID) readings. Soils exhibiting potential for impact (i.e., those exhibiting staining, odors, and/or PID readings) are segregated from soils not exhibiting field-screening evidence of impact. The soils are stockpiled in distinctly separate areas on top of plastic sheeting and covered with plastic sheeting after the completion of work each day to prevent transport of soil contaminants via precipitation and storm water.

After the pipe and bedding materials are installed for a given section, the impacted soils from the subject section of the utility trench are then backfilled into the excavation from the same general area from which they were originally excavated (per TRRP Utility Exclusion – refer to page 15 of manual). This excavation, soil screening, soil segregation, and soil backfill process is completed for each excavated section along the Affected Zone.

Soils displaced by the utility installation (i.e., those not returned to backfill the trench) within the Affected Zone are evaluated by the Environmental Consultant and DWU for potential re-use on other DWU projects. In this case, based on the volume of soil displaced (<250 cy) and field-screening evidence suggesting possible low levels of residual hydrocarbon contamination in the displaced soils, the decision is made to have all of the displaced soils disposed at the selected landfill.

Step 2 – Transport and Disposal of Impacted Soils

The stockpiled soils that were displaced during the utility installation are staged at the site as noted above until they reach a volume feasible for transport to the landfill. Since the soils were pre-approved in this case, an authorized representative of the generator (generator will be DWU in most cases unless contractor accepts generator status) will complete and sign a pre-printed manifest to

accompany each load of soil to the selected landfill facility. The authorized representative will typically be the Environmental Consultant conducting the Project-Specific SGMP oversight.

The trucks return to the site with copies of the manifests that were signed by the landfill. The Environmental Consultant or agent authorized to sign on behalf of DWU collects copies of the executed manifest and forwards them to DWU, which maintains the fully-executed generator copies for their records.

C. Example Process – Managing Impacted Groundwater in the Affected Zone

Step 1 – Containerizing Groundwater

As the project proceeds, groundwater is encountered in one area at levels that are making installation of the utility difficult and the groundwater must be removed. In accordance with the Project-Specific SGMP, the contractor notifies DWU and the Environmental Consultant of the situation. A frac tank (typically 20,000-gallon capacity) is ordered and the groundwater is pumped into the frac tank for storage while utility installation activities proceed. Note that more than one frac tank may be necessary depending on volume.

Step 2 – Groundwater Sampling and Disposal

The DWU-contracted Environmental Consultant then collects a representative composite sample of the groundwater from the frac tank for laboratory analysis. Based on the laboratory results (elevated levels of BTEX) and total volume (40,000 gallons), the Environmental Consultant concludes the optimal method of disposal is through the DWU sanitary sewer. The Environmental Consultant prepares an application for One-Time Groundwater Discharge Authorization for 40,000 gallons of groundwater into a nearby sanitary line. The application is submitted to DWU Pretreatment and Laboratory Services (PALs) for approval. Upon approval, the groundwater is pumped from the frac tanks into the sanitary sewer system under the authorization. *(Note: Discharge to the sanitary sewer is typically metered by DWU PALS and a fee of approximately $2.75 per 1,000 gallons is typically applied – rates as of October 20, 2011)*

D. Example Process – Managing Soils with Higher Contamination Than Previously Documented

Step 1 – Segregation of Affected Soils

The DWU-contracted Environmental Consultant encounters an area of soils exhibiting strong petroleum hydrocarbon odors and elevated PID readings that exceed the previous field-screening observations from the Phase II ESA. These soils (approximately 20 cy) are thus segregated after

excavation from the utility trench and stockpiled on the site separately from the other, Class 2 non-hazardous soils. The appropriate parties listed on the Project-Specific SGMP are notified.

Step 2 – Waste Characterization, Profiling, and Disposal

It is unknown whether these soils exhibiting a higher degree of impact are suitable to be disposed under the existing Class 2 non-hazardous pre-approval; therefore, the Environmental Consultant collects a composite sample of the soils for analysis of BTEX and TPH. The analytical results (total TPH > 1,500 mg/kg) indicate the soil meets the criteria for classification as Class 1 non-hazardous; therefore, a separate profile and landfill approval are obtained for the Class 1 soils and these soils are disposed under this specific profile and associated manifests at the landfill.

DWU Standard Protocol for Soil & Groundwater Management on Construction Sites

Appendix F – Example Site Scenarios

SCENARIO 5 – Unexpected Contamination Encountered During Project

Scenario

DWU is installing a sewer pipeline in far southwest Dallas. Previous evaluation using the DWU Web GIS database did not identify environmental concerns in connection with the project. No Phase II ESA was conducted. During the utility installation, the DWU field inspector notes chemical odors and staining when the soils are being excavated.

Protocol for Proceeding

Step 1 – Communications and Retaining an Environmental Consultant

The DWU field inspector postpones work at the site and calls the DWU project manager to notify them of the findings. The DWU project manager then contacts an approved Environmental Consultant and the consultant meets the DWU project manager and/or field inspector at the site to assess the situation.

Step 2 – Affected Zone Characterization

The Environmental Consultant collects soil samples for analysis to determine the COCs. The analysis indicates that the chlorinated solvent trichloroethylene (TCE) is present in the soil at concentrations ranging from 0.03 mg/kg to 0.55 mg/kg. These levels exceed the Low-High threshold value of 0.017 mg/kg (**Chart 1, Appendix A**). Since the extent of the Affected Zone is not delineated, DWU requests a Phase II ESA from the Environmental Consultant to characterize the Affected Zone. The Phase II ESA results indicate that soils along a 200-ft stretch of the ROW are affected by TCE that appears to be residual contamination from operations at a historic, unregistered manufacturing facility. Based on the depth to groundwater identified in the Phase II ESA, groundwater is not anticipated to intersect the sanitary sewer utility.

Step 3 – Re-Evaluation of Utility Materials and Design

The Environmental Consultant reviews the data collected during the Phase II ESA and compares the COC concentrations to the values in **Chart 1 (Appendix A)**. The detected TCE concentrations in soil indicate a High Contaminant Condition at the site. As a result, DWU contacts the Design Consultant about project materials and design modifications. The Design Consultant utilizes **Chart 3 (Appendix A)** to review available options and modifies the project design to include welded steel pipe, the Trench E-3 embedment specification, and clay cut-off dams along the 200-ft Affected

Zone. The Environmental Consultant is contacted to provide input on the number and location of the clay cut-off dams.

Step 4 – Preparation of Project-Specific SGMP

After the design modifications for the Affected Zone are completed, the DWU project manager completes the **DWU Site Summary Document (Appendix D)** with assistance from the Design Consultant and Environmental Consultant and requests a Project-Specific SGMP from the Environmental Consultant.

Step 5 – Proceeding with Soil and Groundwater Management

DWU submits the Project-Specific SGMP to the contractor and soil management proceeds as outlined in **Appendix I** of the standard protocol manual and in Example Site Scenario 4.

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APPENDIX G

Acronyms and Definitions

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ACRONYMS

AST:	Aboveground Storage Tank
AGCIH:	American Conference of Governmental Industrial Hygienists
APAR:	Affected Property Assessment Report (TCEQ)
APR:	Air-Purifying Respirator
BGS (bgs):	Below Grade/Ground Surface
BTEX:	Benzene, Toluene, Ethylbenzene, and Xylenes
CDW:	Construction-derived Waste
CERCLA:	Comprehensive Environmental Response, Compensation and Liability Act
CESQG:	Conditionally Exempt Small Quantity Generator of Hazardous Wastes
CFR:	Code of Federal Regulations
CI:	Cast Iron
COC:	Chemical of Concern (Contaminant)
DI:	Ductile Iron
DNAPL:	Dense Non-Aqueous Phase Liquid
DOT:	Department of Transportation
EPA:	United States Environmental Protection Agency
ERNS:	Emergency Response Notification System
ESA:	Environmental Site Assessment (Phase I or Phase II)
FRP:	Fiberglass Reinforced Plastic
HASP:	Health and Safety Plan
HAZMAT:	Hazardous materials
HAZWOPER:	Hazardous Waste Operations and Emergency Response
IDLH:	Immediately Dangerous to Life and Health

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ACRONYMS (Cont.)

IOP:	Innocent Owner/Operator Program (TCEQ)
LNAPL:	Light Non-Aqueous Phase Liquid
LPST:	Leaking Petroleum Storage Tank (TCEQ Term)
LQG:	Large Quantity Generator of Hazardous Wastes
MCL:	Maximum Contaminant Level
MSDS:	Material Safety Data Sheets
MTBE:	Methyl Tert-Butyl Ether
NAPL:	Non-Aqueous Phase Liquid
NFA:	No Further Action Letter/Determination
NIOSH:	National Institute of Occupational Safety and Health
NOV:	Notice of Violation
NPDES:	National Pollution Discharge Elimination System
NPL:	National Priorities List
OSHA:	Occupational Safety and Health Administration
PAHs:	Polycyclic Aromatic Hydrocarbons
PCBs:	Polychlorinated Biphenyls
PCE/PERC:	Perchloroethene or Perchloroethylene, aka Tetrachloroethene or Tetrachloroethylene
PEL:	Permissible Exposure Limit (OSHA)
PID:	Photoionization Detector
PPB:	Parts Per Billion
PPE:	Personal Protective Equipment
PPM:	Parts Per Million
PPT:	Parts Per Trillion

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ACRONYMS (Cont.)

PSH:	Phase-Separated Hydrocarbons (petroleum NAPL)
PST:	Petroleum Storage Tank (TCEQ Term)
RCP:	Reinforced Concrete Pipe
RCRA:	Resource Conservation and Recovery Act
REC:	Recognized Environmental Condition
RP:	Responsible Party
SGMP:	Soil and Groundwater Management Plan
SQG:	Small Quantity Generator of Hazardous Wastes
STEL:	Short Term Exposure Limit (STEL)
SVOCs:	Semi-Volatile Organic Compounds
SWF:	Solid Waste Facility
TCE:	Trichloroethylene
TCEQ:	Texas Commission on Environmental Quality
TLV:	Threshold Limit Value (ACGIH)
TPDES:	Texas Pollution Discharge Elimination System
TPH:	Total Petroleum Hydrocarbons
TRRP	Texas Risk Reduction Program
TWA:	Time-Weighted Average (Usually 8 hours)
UST:	Underground Storage Tank
VCP:	Voluntary Cleanup Program (TCEQ)
VOCs:	Volatile Organic Compounds

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DEFINITIONS

Aboveground storage tank (AST), *TCEQ Definition*: A non-vehicular device, (including any associated piping), that is made of non-earthen materials; located on or above the surface of the ground, or on or above the surface of the floor of a structure below ground, such as mine-working, basement, or vault; and designed to contain an accumulation of petroleum products.

Affected soils/groundwater: Soils or groundwater containing chemicals of concern (COCs) at concentrations above laboratory detection limits. Affected soils and groundwater are further classified by degree of contamination (i.e., Low Contaminant Condition, High Contaminant Condition, or Unacceptable Contaminant Condition) using Charts 1 and 2 (Appendix A) of this manual.

BTEX: Acronym for benzene, toluene, ethylbenzene, and total xylenes, all of which are volatile organic compounds (VOCs) commonly found in petroleum hydrocarbon mixtures (e.g., gasoline, diesel, and jet fuel).

Capillary Fringe: A zone of essentially saturated soil just above the water table where water molecules seep up from a water table by capillary action to fill pores. The size distribution of the pores determines the extent and degree of the capillary fringe.

Chemical of Concern (COC), *TRRP Definition*: Any chemical that has the potential to adversely affect ecological or human receptors due to its concentration, distribution, or mode of toxicity.

Chemically Inert (Pipes and Gaskets): Terminology used by piping and gasket manufacturers to indicate that materials are chemically inert and will not react with other chemicals in the subsurface. This term does not indicate that such piping and gaskets are compatible with subsurface contaminants or suitable for use in contaminated environments.

Class 1 Waste (Texas): Texas Class 1 waste is nonhazardous industrial waste classified per 30 TAC 335.505/506/508. Refer to the TCEQ waste designation decision matrix: http://www.tceq.state.tx.us/assistance/waste-matrix

Class 2 Waste (Texas): If waste is not Class 1 (see definition) then it is most likely Class 2. Refer to the TCEQ waste designation decision matrix: http://www.tceq.state.tx.us/assistance/waste-matrix

Class 3 Waste (Texas): If waste is inert, non-liquid, and essentially insoluble then it may be evaluated for Class 3 Waste characterization. Refer to the TCEQ waste designation decision matrix: http://www.tceq.state.tx.us/assistance/waste-matrix

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DEFINITIONS (Cont.)

Dense Non-Aqueous Phase Liquid (DNAPL): NAPL that is denser than water (i.e., has a specific gravity greater than 1) and sinks within a groundwater zone, typically accumulating on a non-permeable confining layer or bedrock surface at the base of the groundwater bearing unit. A common example is the dry cleaning solvent tetrachloroethene (aka, perchloroethene, PCE, or PERC).

Dissolved Solids: Disintegrated organic and inorganic material in water.

Environmental Site Assessment (ESA): See Phase I Environmental Site Assessment

Flame Ionization Detector (FID): A type of gas detector used in gas chromatography.

Free Product: Same as non-aqueous phase liquid (NAPL). See definition of NAPL.

Groundwater Bearing Unit, *TRRP Definition*: A saturated geologic formation, group of formations, or part of a formation which has a hydraulic conductivity equal to or greater than 1×10^{-5} centimeters/second.

Health and Safety Plan (HASP): Site-specific document used to identify the hazards associated with a particular site and to identify the appropriate measures to control those hazards. A HASP should be developed and enforced by the employer of the person potentially to be subjected to the hazards.

Hazardous Materials (HAZMAT): Chemicals, combustible liquids, compressed gases, controlled substances, corrosives, explosives, flammable materials, oxidizers, poisons, radioactive materials, and toxic materials.

Hazardous Substance: 1) Any material that poses a threat to human health and/or the environment. Typical hazardous substances are toxic, corrosive, ignitable, explosive, and/or chemically reactive. 2) Any substance designated by EPA to be reported if a designated quantity of the substance is spilled in the waters of the United States or is otherwise released into the environment.

Leaking Petroleum Storage Tank (LPST) Site, *TCEQ Definition*: A site at which a confirmed release of a petroleum substance from an underground storage tank or aboveground storage tank has occurred. Petroleum substance contamination which results from multiple sources may be deemed as one LPST site by the agency.

Leaking Underground Storage Tank (LUST): An underground tank which has a structural rupture or loss of integrity and its contents are leaving their containment and entering the surrounding environment.

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DEFINITIONS (Cont.)

Light Non-Aqueous Phase Liquid (LNAPL): NAPL that is less dense than water (i.e., has a specific gravity less than 1) and floats on top of the groundwater surface. Common examples include gasoline, diesel, and oil.

Method Detection Limit (MDL), *TRRP Definition*: The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined for each COC from the analysis of a sample of a given matrix type containing the COC.

Method Quantitation Limit (MQL), *TRRP Definition*: The lowest non-zero concentration standard in the laboratory's initial calibration curve and is based on the final volume of extract (or sample) used by the laboratory.

MTBE: Acronym for methyl tert-butyl ether, a common gasoline additive that is highly soluble in water and a common chemical of interest at petroleum storage tank release sites.

Natural Attenuation: The reduction in mass or concentration of a chemical of concern (COC) over time or distance from the source of a COC due to naturally occurring physical, chemical, and biological processes, such as: biodegradation, dispersion, dilution, adsorption, and volatilization.

Non-Aqueous Phase Liquid (NAPL): Contaminants that do not fully dissolve in water, remain undiluted as the original bulk liquid in the subsurface, and/or are present at concentrations greater than their solubility limit.

Parts Per Billion (PPB): Equivalent to micrograms (µg) per kilogram (kg) for solids concentrations, and µg per liter (L), for dissolved-phase aqueous concentrations.

Parts Per Million (PPM): Equivalent to milligrams (mg) per kilogram (kg) for solids concentrations, and mg per liter (L), for dissolved-phase aqueous concentrations.

Perchloroethene (PCE or PERC): Informal colloquial name for the common dry cleaning solvent perchloroethyelene. Also known as tetrachloroethylene or tetrachloroethene. Molecular structure consists of two double-bound carbon atoms (ethene) containing four chlorine atoms.

Permissible Exposure Limit (PEL): A legally-enforceable limit for exposure of an employee to a chemical substance or physical agent. Established by the Occupational Health & Safety Administration (OSHA).

DEFINITIONS (Cont.)

Personal Protective Equipment (PPE): Four levels of protection from occupation-based hazardous and/or chemicals of concern based on the degree of protection provided. Each level consists of a combination of protective respiratory equipment and clothing, which protects against varying degrees of inhalation, eye, or dermal exposure.

- **Level A PPE:** consists of a self-contained breathing apparatus (SCBA) and a totally encapsulating chemical-protective (TECP) suit. Level A PPE provides the highest level of respiratory, eye, mucous membrane, and skin protection.
- **Level B PPE:** consists of a positive-pressure respirator (SCBA or supplied-air respirator) and non-encapsulated chemical-resistant garments, gloves, and boots, which guard against chemical splash exposures. Level B PPE provides the highest level of respiratory protection with a lower level of skin protection.
- **Level C PPE:** consists of an air-purifying respirator (APR) and non-encapsulated chemical-resistant clothing, gloves, and boots. Level C PPE provides the same level of skin protection as level B, with a lower level of respiratory protection. Level C PPE is used when the type of airborne exposure is known and can be guarded against adequately by an APR.
- **Level D PPE:** At DWU construction sites, level D consists of hard hat, eye protection, steel-toed boots, hearing protection, safety vest and gloves (universal precautions). Level D provides no respiratory protection and only minimal skin protection.

Petroleum Storage Tank (PST) Program: TCEQ rules (30 TAC Chapter 334) and program pertaining to the proper installation, operation, and removal of ASTs and USTs containing petroleum substances, as well as assessment and corrective action associated with leaks or releases of petroleum substances from ASTs or USTs.

Phase I Environmental Site Assessment (ESA): A Phase I ESA (ASTM Standard E1527-05) is a systematic, preliminary evaluation of a property to determine whether hazardous substances or petroleum products have been disposed or released there. The Phase I generally consists of a review of public records, interviews with current and previous owners, research into the history of the property, a site visit to determine current conditions and a report. A Phase I ESA usually does not include sampling, though the report may recommend a Phase II ESA.

Phase II Environmental Site Assessment (ESA): A Phase II ESA (ASTM Standard E1903-97) is a further assessment of a property that has previously been determined to have a recognized environmental condition through a Phase I ESA or other screening process. A Phase II ESA generally includes the collection and analysis of air, soil, groundwater, surface water, and/or sediment samples from the site to determine the presence or absence of contamination.

Photoionization Detector (PID): A type of gas detector that measures total volatile organic compounds (VOCs) and other gases in concentrations of parts per billion (ppb) and/or parts per million (ppm).

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DEFINITIONS (Cont.)

Polychlorinated Biphenyls (PCBs): A group of toxic, persistent chemicals formerly used in electrical transformers and capacitors for insulating purposes and in gas pipeline systems as a lubricant. They are classified as a possible carcinogen. The sale and new use of PCBs were banned in 1979. Prior to that time, PCBs were commonly found in oils used in electrical equipment and hydraulic fluids. The compounds were also used in heat transfer liquids, hydraulic fluids, plasticizers, and caulking materials. PCBs strongly attach to plants, soils and sediments. PCBs found in soil can very slowly migrate to groundwater or surface water.

Polycyclic Aromatic Hydrocarbons (PAHs): A group of compounds composed of two or more fused aromatic rings. PAHs are introduced into the environment through the combustion of organic materials (i.e., forest fires, automobile exhaust, and fossil fuel power plants). They are also found in petroleum products and are regulated by the Texas Commission on Environmental Quality (TCEQ) Petroleum Storage Tank (PST) program.

Protective Concentration Level (PCL), *TRRP Definition*: The concentration of a chemical of concern (COC) which can remain within the source medium and not result in levels which exceed the applicable human health risk-based exposure limit or ecological protective concentration level at the point of exposure for that exposure pathway.

Recognized Environmental Condition (REC), *ASTM Definition*: The presence or likely presence of any hazardous substances or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances or petroleum products into structures on the property or into the ground, ground water, or surface water of the property. The term includes hazardous substances or petroleum products even under conditions in compliance with laws.

Risk Assessment: A study to determine risks posed by a contaminated site if no cleanup action is taken and to establish what cleanup levels would be protective of human health and the environment. There are two types of risk assessments. A human health risk assessment looks at the risks to humans from contamination at the site. An ecological risk assessment looks at the risks to ecosystems, such as plants, fish, and animals, from contamination at the site.

Sample Detection Limit (SDL), *TRRP Definition*: The method detection limit, as defined in this section, adjusted to reflect sample-specific actions, such as dilution or use of smaller aliquot sizes than prescribed in the analytical method, and to take into account sample characteristics, sample preparation, and analytical adjustments.

Saturated Zone: The area below the water table where all open spaces are filled with water under pressure equal to or greater than that of the atmosphere.

Smear Zone: Soils between the upper and lower limit of the top of the groundwater table. Soil in this range becomes saturated by groundwater and associated contaminants parts of the year due to water table fluctuations.

Semi-Volatile Organic Compounds (SVOCs): Organic (carbon-containing) compounds that partially evaporate or change from liquid to gas slowly at normal temperatures.

DEFINITIONS (Cont.)

Solubility: Physical property referring to a COC's "ability" to dissolve in a solvent (in the case of this document, water).

Short Term Exposure Limit (STEL): the concentration to which workers can be exposed continuously for a short period of time without suffering from irritation, chronic or irreversible tissue damage or narcosis of sufficient degree to increase the likelihood of accidental injury, impair self-rescue or materially reduce work efficiency.

Texas Risk Reduction Program (TRRP): TCEQ rules (30 TAC 350) and program pertaining to site assessments, risk-based corrective action, and site remediation.

Threshold Limit Value (TLV): Level of a chemical substance to which it is believed a worker can be exposed day after day for a working lifetime without adverse health effects. Strictly speaking, TLV is a reserved term of the American Conference of Governmental Industrial Hygienists (ACGIH).

Total Petroleum Hydrocarbons (TPH): For sites in Texas, both aliphatic (strait-chain and branched) and aromatic (benzene-ring containing) hydrocarbons containing between 6 and 35 carbon atoms. Analyzed by TCEQ Method TX 1005.

Trichloroethene (TCE): Also known as trichloroethylene. A chlorinated solvent used in many industries for cleaning, degreasing, and other purposes. Also a common natural degradation product of the common dry cleaning solvent perchloroethene (PCE).

Underground Storage Tank (UST), *TCEQ Definition*: Any one or combination of underground tanks and any connecting underground pipes used to contain an accumulation of regulated substances, the volume of which, including the volume of the connecting underground pipes, is 10% or more beneath the surface of the ground.

Unsaturated Zone: The zone between land surface and the capillary fringe within which the moisture content is less than saturation and pressure is less than atmospheric. Soil pore spaces also typically contain air or other gases. The capillary fringe is not included in the unsaturated zone.

Vadose Zone: Alternative term for the Unsaturated Zone, refer to Unsaturated Zone definition.

Volatile Organic Compounds (VOCs): Organic (carbon-containing) compounds that evaporate (volatilize) readily at room temperature.

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APPENDIX H

Common Chemicals of Concern (COCs) and their Sources

Appendix H – Common COCs and their Sources

Various chemicals of concern (COCs) are encountered during utility construction projects, primarily those completed in urban areas near current and/or historical commercial and industrial business activities.

COC Sources

These COCs are directly related to the chemicals and materials that various commercial/industrial businesses use in routine operations and the waste streams associated with those operations. The types of businesses that represent potential concerns and possible sources of COCs include the following. The list contains the business type followed by the potential COC categories. The most common sources and COCs are bolded.

Agricultural (gardening centers, tree farms, fertilizer and pesticide sales/distribution)
Fertilizers, herbicides, pesticides, metals, petroleum products, solvents

Aircraft or airport operations
Fuels, grease and lube oil, waste oil, acids, chlorinated solvents, de-icing fluid (glycols) hydraulic fluids, metals, paints (metal pigments)

Automotive operations (repairs, sales, service stations)
Acids, alkalis, antifreeze (glycols), brakes (asbestos), **fuels**, **grease and lube oil**, paints (metal pigments), **thinners**, **chlorinated solvents**, **petroleum solvents**, **waste oil**, **transmission fluids**, **metals**

Cabinet making, woodworking, furniture shops, lumber yards
Oils, paints, polishes, resins, stains, solvents, thinners, glues, wood preservatives, tar, metals, lubricants

Carpet or textile manufacturing
Acids, alkalis, insecticides, lubricants, solvents, glues, paints, dyes, fungicides, PCBs

Ceramics manufacturing
Metals, solvents, PCBs

Drycleaners, laundries
Chlorinated solvents, petroleum solvents, sizing agents, **spotting agents,** alcohols, surfactants, bleaches, alcohols

Electroplating, machine shop, metal workings
Acids, alkalis, petroleum solvents, cutting oils, chlorinated solvents, naphtha, metals, waste oils

Exterminators
Insecticides, herbicides, pesticides, rodenticides

Fire stations
Alcohols, lubricants, fuels, petroleum solvents, chlorinated solvents

Glass operations (manufacture, repairs)
Acetates, resins, chlorinated solvents, turpentine, paints, metals

Highway maintenance (city, county, state)
Asphalt**, lubricants, solvents, tar,** metals**, fuels**

Medical facilities
Fuels, solvents

Paint manufacturers, distributors
Acids, alkalis, coal tar products, cutting oils, resins, paint pigments (metals), solvents, thinners, mineral spirits, driers

Photoshops, developing services
Acids, alkalis, acetates, metals (silver)

Printers
Alkalis, metals, inks, dyes, solvents, lubricants, resins, varnishes

Refrigeration equipment (HVAC)
Lubricants, metals, refrigerants, acids

Roofing supplies, services
Asbestos, asphalt, tar, petroleum solvents, chlorinated solvents

Recyclers (metal), scrap yards
Greases, lubricants, fuels, petroleum solvents, chlorinated solvents, metals, PCBs

Trucking facilities
Fuel, heating oil, **lubricants, petroleum solvents, chlorinated solvents, metals,** PCBs

Inorganic vs. Organic COCs

There are two broad categories of COCs, organics and inorganics. Organic compounds (meaning "containing carbon") of interest in utility construction project planning are almost completely petroleum or petroleum-based compounds: motor fuels (gasoline, diesel), burner fuels (kerosene, fuel oil), lubricants (motor oils and greases), petroleum solvents (Stoddard, naphtha, mineral spirits, paint thinner), halogenated solvents (trichloroethene [TCE], and tetrachloroethene or perchloroethylene [Perc or PCE]), and degraded sealing or binding agents (tar and asphalt). Even most pesticides and PCBs (poly-chlorinated biphenyls, found in older transformer oils) are petroleum-based.

The inorganic category includes mineral acids such as hydrochloric (HCl), sulfuric (H_2SO_4), nitric (HNO_3) and others, but is comprised primarily of metals.

Metals

The metal lead (Pb) is often found in and along ROWs and may be found in areas where no particular commercial operation has been active. Lead concentrations along older ROWs have frequently been attributed to historic, non-specific vehicle emissions during the many years when vehicles burned leaded gasoline.

Lead and other metals also originate from business activities that handle metals on a daily basis, such as metal-working manufacturing facilities, machine shops, chrome or zinc plating operations, salvage yards and scrap recyclers. Less obvious sources of metals include businesses such as film developers, medical labs with on-site x-ray equipment, automotive service shops, oil change facilities, paint shops and others that generate wastes which can contain elevated levels of various metals. Arsenic was also a common defoliant and pesticide in past agricultural practices.

It should also be noted that various metals, including but not limited to arsenic, lead, and chromium occur naturally in soils and rock at varying concentrations.

Petroleum Hydrocarbons

The largest general class of COCs that will be encountered at DWU projects will be petroleum hydrocarbons. Common petroleum hydrocarbon sources include gasoline, diesel, jet fuel, kerosene, heating oils, automotive fluids, and waste oil. There are also various petroleum-distillate mixtures utilized as degreasers (e.g., Naphtha and Stoddard solvent).

Petroleum Hydrocarbon VOCs and BTEX

Petroleum hydrocarbon mixtures contain a variety of COCs and are typically evaluated in Texas through the analysis of Total Petroleum Hydrocarbons (TPH) and Volatile Organic Compounds (VOCs). The primary COCs in petroleum hydrocarbon mixtures include the VOCs benzene, toluene, ethylbenzene, and total xylenes (collectively referred to as BTEX). BTEX and other petroleum hydrocarbon VOCs occur at the highest concentrations in gasoline, and are notably less common in heavier or higher-boiling-point petroleum hydrocarbon mixtures like diesel, jet fuel, and heating oil. Benzene is the most toxic of these petroleum hydrocarbon VOCs and has the lowest regulatory assessment and cleanup standards. Therefore, benzene is considered the "driver COC" on most petroleum hydrocarbon release sites.

MTBE

Another common COC for gasoline releases is methyl tert-butyl ether (MTBE), which is a common gasoline additive that has caused widespread groundwater contamination across the country. MTBE is toxic, polar, highly soluble in water, and typically migrates at a faster rate in groundwater plumes compared to other gasoline COCs.

PAHs

Polycyclic aromatic hydrocarbons (PAHs) are another class hydrocarbons typically considered when assessing petroleum hydrocarbon releases. PAHs consist of groups of two or more fused benzene rings and results from the incomplete combustion of organic materials. They occur in petroleum products at relatively low concentrations as a by-product of the refining process. PAHs are typically evaluated for petroleum releases in Texas when TPH is detected at concentrations exceeding C_{12} (12 carbon atoms). PAHs may also be present in fill material or garbage dumps, especially when the fill material or waste contains burned or partially burned materials. PAHs have been found in fill material in various locations in and around the downtown Dallas area and are thought to be related to burned building debris in this fill material.

Chlorinated Solvents

Chlorinated solvents are VOCs containing one or more chlorine atoms. They are common degreasers and cleaners utilized in various industrial and manufacturing operations, as well as automotive service and repair operations.

PCE or Perc

One of the most-common chlorinated solvents encountered in urban areas is tetrachloroethylene, which is also referred to as perchloroethylene (PCE or Perc). PCE is the common dry cleaning

solvent responsible for the widespread soil and groundwater contamination observed at dry cleaning facilities. PCE has low regulatory cleanup and assessment levels in soils and groundwater and is often a "driver COC" in most investigations and cleanups. PCE is also utilized as a cleaner and degreaser in various commercial and industrial settings. When in the subsurface, PCE commonly biodegrades to the toxic daughter compounds trichloroethylene (TCE), cis-1,2-dichloroehtylene (cis-1,2-DCE), trans-1,2-dichloroethylene (trans-1,2-DCE) and vinyl chloride. The biodegradation process generally occurs very slowly and PCE is this considered a recalcitrant compound.

TCE

Trichloroethylene (TCE) is another common chlorinated solvent encountered in urban areas. TCE also has low regulatory cleanup and assessment levels in soils and groundwater and is often a "driver COC" in many investigations and cleanups. It is commonly utilized as a cleaner and degreaser in various commercial and industrial settings. When in the subsurface, TCE commonly biodegrades to the toxic daughter compounds trichloroethylene cis-1,2-dichloroehtylene (cis-1,2-DCE), trans-1,2-dichloroethylene (trans-1,2-DCE) and vinyl chloride. The biodegradation process generally occurs very slowly and TCE is this considered a recalcitrant compound.

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APPENDIX I

Standard Soil & Groundwater Management Procedures

DWU Standard Protocol for Soil & Groundwater Management on Construction Sites

Appendix I – Standard Soil and Groundwater Management Procedures

The objectives of a Project-Specific SGMP document are to:

- Outline procedures to guide underground construction through the potentially impacted soil and/or groundwater in the "Affected Zone" defined below;
- Provide guidance for the management of the impacted or potentially impacted soil and/or groundwater during construction within the Affected Zone; and
- Provide guidance for the reuse/disposal of impacted soil and groundwater within the Affected Zone.

Each Project-Specific SGMP document for DWU should be prepared prior to the start of construction and should contain sections that include the following:

- Establishing an Affected Zone;
- Soil Management Plan;
- Groundwater Management Plan;
- Key DWU Project Contacts; and
- Work-Site Security.

The Project-Specific SGMP prepared for DWU will outline the responsibilities of the Contractor regarding implementation of the plan. Additionally, the Project-Specific SGMP provides procedures for modifying the plan in the event site conditions change or a change to the plan is assumed beneficial to the project. DWU personnel should be notified of any unexpected conditions encountered on the site.

Contractor Responsibilities Under the Project-Specific SGMP

The Contractor will be responsible for following procedures identified in the Project-Specific SGMP for all work within the Affected Zone limits. Excavation, embankments, excavation and backfill for structures, and related work within the limits of the Affected Zone will be measured and paid for as specified under the respective bid/pay item. Within the limits set forth in the Project-Specific SGMP, the Contractor may be responsible for the following tasks:

- Interim soil stockpile area installation and operating costs;
- Construction equipment decontamination costs;
- Contaminated wastewater storage, contaminated wastewater treatment system mobilization / demobilization, contaminated wastewater treatment related permits or fees, contaminated wastewater treatment system operation and disposal costs;
- Contaminated water dewatering and wastewater treatment;
- Installation and maintenance of utility controls to prevent contaminated soil or wastewater from entering the existing storm sewer; and
- Affected soil and/or groundwater handling, storage, transportation and disposal costs with the exception of transporting and disposing of hazardous wastes.

These tasks should be defined in both the Project-Specific SGMP and the RFP documents, and

they should also be included as pay items in the final contract with the Contractor. The Contractor is responsible for the means and methods of managing impacted soil and groundwater in accordance with the Project-Specific SGMP.

DWU Responsibilities Under the Project-Specific SGMP

DWU will be responsible for contracting an approved Environmental Consultant to oversee the soil and groundwater management field activities and implementation of the Project-Specific SGMP.

In accordance with DWU policy, the Environmental Consultant must have the following minimum qualifications:

- Professional Registration as a P.E. (Professional Engineer), P.G. (Professional Geologist), REM (Registered Environmental Manager), CHMM (Certified Hazardous Materials Management), or other certification approved by DWU; or
- Working under the direction of a P.E., P.G., REM, or CHMM; and
- Two years of sampling and management of COCs similar to those located on the project site for soil and groundwater; and
- 40-Hour HAZWOPER training in accordance with 29 CFR 1910.120.

DWU project engineers and inspectors may also conduct periodic field oversight of construction activities within the Affected Zone to ensure the Project-Specific SGMP Contractor is being properly implemented. The DWU field inspector or project engineer may suspend work on a DWU project site wholly or in part during the testing, removal, or disposition of affected soils and/or groundwater on the DWU project site in order to protect contractor personnel, DWU personnel, the public and/or the environment.

Establishing the Affected Zone

The Affected Zone within the project site is established based on the results of the Phase II ESA and site information provided by the environmental firm to DWU, which describes the location of affected soils and/or groundwater. The Phase II ESA will describe the horizontal and vertical limits of the impacted environmental media within the Affected Zone and will provide a figure identifying the Affected Zone on the project site. The location of NAPL, if present, will also be identified.

The limits of the Affected Zone as shown on the figures provided by the Environmental Consultant are only an estimate based on the available subsurface data. Note that actual field conditions may vary from those described in the Phase II ESA report. If impacted soil and/or groundwater are encountered outside the limits of the Affected Zone as defined in the Phase II ESA or other environmental report, the Project-Specific SGMP should be modified accordingly.

Soil Management Procedures

This following general procedures should be followed:

- Management of impacted or potentially-impacted soil;
- Decontamination of soil excavation and moving equipment; and
- Final disposition of impacted soil from the Affected Zone (Re-use or Disposal).

Impacted and potentially-impacted soil should be screened regularly during construction within the Affected Zone using a photoionization detector (PID). The location and frequency for obtaining readings/samples will be based on site-specific conditions and will be up to the Environmental Consultant. As a general rule of thumb, one representative soil sample for approximately every 10 cubic yards of the excavated soil should be field screened. Screening will also include sensory evidence of impacts (i.e., staining and/or chemical odors). The soil screening activities and readings should be documented in the field as they are obtained.

Prior to the start of excavation within the Affected Zone, the Environmental Consultant and Contractor should identify designated areas for soil stockpiling. In selecting these areas, consideration should be given to storm water flow direction, so as not to impede storm water runoff, and to avoid low-lying areas prone to flooding. Stockpile areas should be free of monitor wells, utility manholes, or any other access routes to the subsurface. Soil excavated from the Affected Zone should be placed on plastic sheeting (minimum 20-mil thick) in the designated stockpile area. The stockpiled soil should be covered with plastic sheeting when the stockpile is not being actively worked (end of each work day at a minimum). The Contractor shall take the necessary steps to secure the cover. The cover is typically anchored in place with sand bags or other comparable means. Additionally, the Contractor shall take the necessary steps to direct storm water runoff away from the stockpile area.

Impacted soil excavated from the Affected Zone as a part of the normal construction activities should be reused, or disposed of off-site, as defined in the Project-Specific SGMP. Impacted soil may be placed back into the trench as backfill, as referenced by TRRP Rule 30 TAC 350.36 (a) – TRRP Utility Exclusion, assuming the soil meets DWU standard specifications for backfill materials. If NAPL is present in the stockpiled soil, then the excavated soil should be treated as a waste and managed in accordance with 30 Texas Administrative Code (TAC) 335, Subchapter R.

Should DWU desire to re-use the excess impacted soil outside of the Affected Zone, rather than dispose of it off-site as a waste, the Project-Specific SGMP will require modification and amendment to meet the requirements of 30 TAC 350.36. This option, however, is not recommended due to the cost of laboratory testing required to demonstrate the soil is suitable for re-use at another site.

The Project-Specific SGMP should specify that the impacted soil will be segregated from the non-impacted soil on the project site.

The Project-Specific SGMP should also specify that, when returning impacted soils to the utility trench per the TRRP Utility Exclusion, impacted soils should be placed back into the trench in the same general location as where they were originally excavated. Excess contaminated soil should never be placed into non-contaminated areas of the trench.

If off-site disposal of soils is required, the Project-Specific SGMP should specify the selected disposal facility. Additionally, the waste characterization soil sampling frequency and laboratory analytical tests required by the disposal facility should be specified in the Project-Specific SGMP. The waste characterization, profiling, and associated analytical testing will be the responsibility of the Environmental Consultant.

The Project-Specific SGMP should provide specifications for the decontamination of all construction equipment that had contact with potentially- impacted soil and groundwater within the Affected Zone. All construction equipment utilized in the Affected Zone shall remain at the work site until decontamination in accordance with the procedures defined in the SGMP.

When working with impacted soils in the Affected Zone, the following records should be documented and retained:

- Daily field log and field data including PID readings;
- Copies of analytical laboratory reports including chain-of-custody forms;
- Photo documentation of pertinent features and events; and
- Waste documentation including, but not limited to, waste profiles, manifests, etc.

Groundwater Management Procedures

If groundwater is expected to be encountered in the Affected Zone, the Project Specific SGMP should include proper procedures for groundwater management. The plan should specify that the contractor is responsible for the groundwater management procedures.

During construction, if de-watering of groundwater or storm water from impacted excavations is necessary as part of construction activities, various groundwater management procedures should be specified within the Project-Specific SGMP.

Removal of groundwater or storm water shall be via pumps and hoses by the Contractor to a holding tank adequately sized for the anticipated volume of water to be removed from the trench. A common water storage method includes frac tanks, which typically have a capacity of 20,000 gallons. To reduce the quantity of potentially-impacted water requiring storage and disposal, the Project-Specific SGMP should specify the work sequence in the Affected Zone in a manner that limits the length of open trench at any given time.

At the completion of construction activities in the Affected Zone, or as the tank reaches its capacity, the tank(s) contents should be properly sampled and disposed in accordance with the disposal facility requirements. The Project-Specific SGMP should indicate that the Contractor is responsible (including costs) for obtaining all permits or authorizations that may be required for the disposal of contaminated water from the Affected Zone to a permitted disposal facility or point of discharge (e.g., disposal to the DWU sanitary sewer system or the storm sewer).

If NAPL is encountered in the groundwater during excavation, the contractor shall separate the NAPL-contaminated water from the water impacted by dissolved-phase contaminants. The NAPL-contaminated water should be placed in a separate holding tank. The NAPL contaminated water should be disposed at a permitted facility.

Potentially-impacted water stored in the holding tank(s) can either be disposed by:

- Vacuum truck and treatment/recycling facilities: These facilities can accept water with moderate to high levels of contamination, including NAPL for petroleum, and typically have less-stringent profiling requirements; however, they are relatively costly (e.g., ranging from $0.30 to $0.90/gallon) and are better for smaller volumes of water.
- Discharge to DWU Sanitary Sewer: Metered discharge via One-Time Groundwater Discharge Authorization obtained through DWU Pretreatment and Laboratory Services (PALs). The sanitary sewer can accept water with low to moderate levels of contamination and is relatively inexpensive. The average cost is $2.75 per 1,000 gallons as of October 20, 2011.
- Discharge to Storm Sewer: Authorization by City of Dallas Storm Water Management Section is likely required. Disposal of contaminated water into the storm sewer will also likely require pre-treatment and the completion of a Texas Pollution Discharge Elimination System (TPDES) permit. Costs associated with preparation of the permit and pre-treatment of the water may be prohibitive based on the volume to be discharged (e.g., generally more cost-effective for large volumes).

When working with potentially-impacted groundwater or storm water in the Affected Zone, the following records should be documented and retained:

- Daily log describing the related activities, observations, and volume of water pumped and stored each day;
- Copies of the analytical laboratory reports including chain-of-custody forms; and
- Waste documentation including, but not limited to, waste profiles, manifests, etc.

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APPENDIX J

Construction Worker Health & Safety Considerations

DWU Standard Protocol for Soil & Groundwater Management on Construction Sites

Appendix J – Construction Worker Health & Safety Considerations

During construction within a designated Affected Zone, environmental safety precautions should be followed that are protective of:

- the general public;
- DWU employees;
- DWU's consultant's employees; and
- DWU's contractor's and subcontractor's employees.

Environmental Health and Safety Plan (HASP)

DWU's contractors are required to prepare site-specific HASPs for each job site in which hazardous materials will be potentially encountered. HASPs are site-specific documents used to identify the hazards associated with a particular site and to indicate the appropriate measures to control those hazards so the job can be performed safely. Safety aspects of site operations shall be thoroughly identified prior to commencing field work. A job and site-specific HASP:

- shall include a site characterization and job hazard analysis that includes all reasonably anticipated chemical, physical, and/or biological hazards;

- shall be developed in accordance with OSHA *Hazardous Waste Operations and Emergency Response (HAZWOPER)* standard 29 CFR 1910.120; and

- shall document that all workers (contractors and subcontractors) who have the potential to contact hazardous materials within a designated Affected Zone have completed the training requirements and medical monitoring under OSHA standard 29 CFR 1910.120 (e).

Each employer (i.e., contractor, subcontractor, consultant, etc.) is responsible for preparing their own HASP for their employees. In addition, the DWU contractor is responsible for overall health and safety on the project site. Accordingly, the DWU contractor's HASP shall be made available to all DWU employees, contractors, and/or subcontractors present at the project site who will be performing activities listed in the HASP or working within the designated area(s) addressed by the HASP. Each of the contractor's employees and subcontractors shall sign the HASP, indicating they have reviewed the HASP and understand it.

After the field work commences, subsequent visitors to the site that enter a controlled work zone designated in the HASP must also review and sign the HASP. The HASP shall be modified as needed through every stage of site activity and whenever new information about site hazards is obtained.

For proper documentation, a copy of the HASP with completed signature pages should be included in the final summary documentation provided by the contractor to DWU.

DWU Standard Protocol for Soil and Groundwater Management on Construction Sites: Appendix J

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DWU personnel who will be entering a project site that contains or potentially contains hazardous materials should review the Project-Specific SGMP prior to entering the site. Additionally, DWU personnel are required to know and follow DWU's standard health and safety procedures. **In no circumstance should DWU personnel maintain responsibility for the preparation of a HASP for use by non-DWU personnel.**

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APPENDIX K

Dallas Area Soil and Groundwater Disposal Options

Appendix K – Dallas Area Soil and Groundwater Disposal Options

Non-Hazardous Waste Landfills – Class 2

Arlington Sanitary Landfill
(Managed by Republic Services)
800 Mosier Valley Road
Euless, TX 76040
(817) 354-2300

Republic Services
Camelot Landfill
580 Huffines Boulevard
Lewisville, TX 75056
972-492-3888

Republic Services
ECD Landfill
5703 N. IH-45
Ennis, TX 75119
972-875-5374

Waste Management
DFW Landfill
1600 S. Railroad Street
Lewisville, TX 75067
972-315-5421

City of Dallas
McCommas Bluff Landfill
5100 Youngblood Road
Dallas, TX 75231
214-670-0977
(Technically accepts Class 2 soils,
but difficult to obtain approval*)

Non-Hazardous Waste Landfills – Class 1

Waste Management
Skyline RDF
1201 N. Central Avenue
Ferris, TX 75125
972-842-5710
(Accepts Class 2 soils and Class 1 soils
due to high TPH [>1,500 ppm] only*)

Republic Services
Itasca Landfill
2559 FM 66
Itasca, TX 76055
254-687-2511
(Accepts Class 2 soils and Class 1 soils due
to both high TPH [>1,500 ppm] and leachable
toxic constituents*)

Hazardous Waste Facilities

U.S. Ecology, Inc.
3277 County Road 69
Robstown, TX 78380
1-800-242-3209
(Hazardous waste treatment and disposal)

Clean Harbors
Deer Park Incineration Facility
2027 Independence Parkway South
La Porte, TX 77571
281-930-2300
(Hazardous waste incinerator and RCRA landfill)

Clean Harbors
Lone Mountain Landfill
Route 2, Box 170
Waynoka, OK 73860
580-697-3500
(Hazardous waste treatment and disposal)

Water Recycling/Disposal

Storm Sewer: Contact City of Dallas Storm Water Department, TCEQ Texas Pollution Discharge Elimination System (TPDES) permit likely required. Treatment likely required for contaminated water.
http://www.dallascityhall.com/pwt/storm_water_management.html

Sanitary Sewer: Contact Pretreatment and Laboratory Services to obtain One-Time Groundwater Discharge Authorization. Treatment may be required for higher levels of contamination.
http://www.dallascityhall.com/dwu/Pretreatment/discharge_groundwater.html

ASI Environmental Services
1013 IH-45 South
Hutchins, TX 75141
972-225-6500
(Vacuum Trucks, Water Treatment/Recycling and Disposal)

FCC Environmental
320 Scroggins Road
Springtown, TX 76082
1-800-252-6444
(Vacuum Trucks, Water Treatment/Recycling and Disposal)

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APPENDIX L

SGMP Related Pay Items

DWU Standard Protocol for Soil & Groundwater Management on Construction Sites

Appendix L – SGMP Related Pay Items

- **ITEM NO. 1801__ __" PVC WATER PIPE WITH NITRILE GASKETS**
  - This item consists of furnishing and placing approximately __ Linear Feet of __" Polyvinyl Chloride Water Pipe (C-900) with nitrile gaskets in accordance with **Item 506. Open Cut – Water Conduit Installation, Item 506.5.COD: Hydrostatic Test, Item 506.6.COD: Connections To Existing Water Conduits, Item 506.6.1.COD: Water Main Tie-In During Off Hours, Item 506.6.2.COD: Shutdown of Water Mains 20" Diameter and Larger, Item 506.7.3.2.COD: Flushing Method, Item 506.7.COD: Disposal of Heavily Chlorinated Water Main Flushing Water, Item 506.7.1.COD: Preliminary Flushing, Item 506.7.2.COD: Chlorination, Item 506.7.3.COD: Flushing, Item 506.7.4.COD: Disposal of Flushing Water, Item 506.7.5.4.COD: Sampling, Item 506.7.6.COD: Indemnification, Item 506.8.1.COD: Cut and Plugs, Item 501.14. Polyvinyl Chloride (PVC) Water Pipe, Item 501.14.5.COD: Fittings, and Item 501.14.6.COD: NSF 61 Compliance** of these specifications and addenda thereto.
  - This item includes fittings, polywrap for fittings, mechanical tamping, diagonal utilities, barricading and all embedment materials.
  - Measurement and payment will be in accordance with **Item 506.9. Measurement and Payment** of these specifications.
  - *This item is used only for projects where soil and groundwater testing has determined that there are contaminants which can damage standard gaskets. Use the following size indicators: H = 6" PVC Water Pipe; J = 8" PVC Water Pipe; L = 12" PVC Water Pipe.*

- **ITEM NO. 3111__ __" PVC PRESSURE RATED WASTEWATER PIPE WITH NITRILE GASKETS**
  - This item consists of furnishing and placing approximately __ Linear Feet of __" Polyvinyl Chloride Pressure Rated Wastewater Pipe with nitrile gaskets conforming to ASTM D2241 (DR 26) Minimum Pressure Rating of 160 PSI and ASTM D3139 joints, and in accordance with **Item 507. Open Cut – Wastewater Conduit Installation, Item 507.5.1.1.COD: Infiltration Test, and Item 501.15. Polyvinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series)** of these specifications and addenda thereto.
  - This item to include barricading and all embedment materials.
  - Measurement and payment will be in accordance with Item **Item 507.6. Measurement and Payment For Wastewater Conduit Installation** of these specifications.
  - *This item is used only for projects where soil and groundwater testing has determined that there are contaminants which can damage standard gaskets Use this item for pipe sizes 12" and smaller. Use the following for size indicators: H = 6" PVC Pressure WW Pipe; J = 8" PVC Pressure WW Pipe; K = 10" PVC Pressure WW Pipe; L = 12" PVC Pressure WW Pipe.*

- **Disposal of Non-Hazardous Class I Industrial Waste Soils (7765)**
  - This item is to reimburse the Contractor for costs to handle, transport, and dispose of __Cubic Yards of Class I Non-Hazardous Industrial Waste Soils. This item shall include all equipment, materials, permits, approvals, treatment, transportation fees, disposal fees, labor, and all other costs necessary to handle, transport, and dispose of Class I Non-Hazardous Industrial Waste Soils.
  - This is a contingent item and payment will only be made if directed by the Construction Engineer. Basis for payment shall be per Cubic Yard of Class I Non-Hazardous Industrial Waste Soils.

- **Disposal of Non-Hazardous Class II Industrial Waste Soils (7766)**
  - This item is to reimburse the Contractor for costs to handle, transport, and dispose of __ Cubic Yards of Class II Non-Hazardous Industrial Waste Soils. This item shall include all equipment, materials, permits, approvals, treatment, transportation fees, disposal fees, labor, and all other costs necessary to handle and dispose of Class II Non-Hazardous Industrial Waste Soils.
  - This is a contingent item and payment will only be made if directed by the Construction Engineer. Basis for payment shall be per Cubic Yard of Class II Non-Hazardous Industrial Waste Soils.

- **Disposal of Contaminated Groundwater (7767)**
  - This item is to reimburse the Contractor for costs to handle, transport, and dispose of ___ Gallons of Contaminated Groundwater. This item shall include all equipment, materials, permits, approvals, pumping to holding tank prior to testing, holding tank, treatment, transportation fees, disposal fees, labor, and all other costs necessary to handle, transport, and dispose of Contaminated Groundwater. This is a contingent item and payment will only be made if directed by the Construction Engineer. Basis for payment shall be per Gallon of Contaminated Groundwater that is disposed.

- **Health, Safety, and Monitoring Plan (7768)**
  - The contractor must reference the Project-Specific Soil & Groundwater Management Plan (SGMP) prepared by DWU and prepare a Health, Safety, and Monitoring (HSM) Plan that meets the requirements of OSHA's Hazardous Waste Operations and Emergency Response (HAZWOPER) Standard, 29 CFR 1910.120 or 29 CFR 1926.65, paragraph (b)(4). Contractor must provide copy of HSM Plan to DWU. The item includes all equipment, materials, labor, testing and maintenance necessary to monitor for potentially hazardous waste material in areas specified. Payment will be lump sum. *For use on all projects where known issue has been determined by Phase II ESA report.*

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APPENDIX M

References

DWU Standard Protocol for Soil & Groundwater Management on Construction Sites

Appendix M – References and Useful Links

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TCEQ, Texas Risk Reduction Program (TRRP), Tier 1 Protective Concentration Level (PCL) Tables: http://www.tceq.texas.gov/remediation/trrp/trrppcls.html

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