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CONTROL NO. 002A

CONTRACT NO.	DELIVERY ORDER #	ACTIVITY LOCATION
N62472-99-D-0032	0040	NWS Earle, Colts Neck, New Jersey

PROJECT TITLE:
Landfill Capping OU-6, Sites 3 & 10

FROM:	DATE
Foster Wheeler Environmental Corp. – Program QCM: Mark Miller	August 21, 2001
TO:	DATE
C. Davis (1copy)	August 21, 2001

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ITEM NO.	SUBMITTAL DESCRIPTION	PREPARED/ SUBMITTED BY	APPROVED	DISAPPROVED	REMARKS
2	SD-08, Statements; Soil Erosion and Sediment Control Plan Report – Site 3	R. Woodworth			Submittal includes: Report & Drawings

SOIL EROSION AND SEDIMENT CONTROL PLAN REPORT

- FOR -

Naval Weapons Station Earle – Site 3
Colts Neck, Monmouth County, New Jersey

Submitted by:

Department of the Navy
Engineering Field Activity, Northeast
Naval Facilities Engineering Command
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AUGUST 20, 2001

KEITH BOGATCH, PE
NJPE NO. 40359

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- T-1 Title Sheet
- C-1 General Notes and Proposed Sequence of Construction
- C-2 Soil Erosion and Sediment Control Notes and Details
- C-3 Existing Site Conditions
- C-4 Clearing and Grubbing , Soil Erosion and Sediment Control Measures
- C-5 Final Grading Plan
- C-6 Cap Cross-Sections, Details and Stormwater Management Details

1.0 INTRODUCTION

Foster Wheeler Environmental Corporation (FWENC) has been retained by the Department of the Navy, under Contract Task Order N62472-99-D-0032 CTO No. 40, to prepare a Soil Erosion and Sediment Control Plan for the remedial actions to be conducted at Site 3 of the Navy Weapons Station (NWS) Earle. This Soil Erosion and Sediment Control Plan Report (hereinafter referred to as the "SESC Plan Report") has been prepared for the capping of a former landfill located on Site 3. The closure of the Site 3 landfill is being performed in accordance with the approved closure plan and a Record of Decision (ROD) with the United States Environmental Protection Agency (USEPA) for this site.

1.1 Background

The NWS Earle, commissioned in 1943 to supply ammunition to the naval fleet, is located in Monmouth County, New Jersey approximately 47 miles south of New York City. The location of the NWS Earle is depicted on Figure 1, included in Appendix A of this report. The NWS Earle consists of two areas (i.e., the Mainside Area and the Waterfront Area), which are interconnected via a Navy-controlled right-of-way and access road.

The Mainside Area is located in Colts Neck Township, Monmouth County, New Jersey. Site 3 (hereinafter referred to as the "subject site") is located in the Mainside Area. The location of Site 3 is depicted on Figure 2 included in Appendix A of this report.

The subject site encompasses an area of approximately five (5) acres that is reported to have been utilized from 1960 to 1968 for the disposal of domestic and industrial wastes. As stated in a document entitled Proposed Plan for Site 3 and 10 (OU-6), Naval Weapons Station Earle, Colts Neck, New Jersey dated May 2001 and prepared by Tetra Tech Nus, Inc., the industrial wastes are reported to have included paints and paint thinners, solvents, varnishes, shellac, acids, alcohols, caustics, pesticide containers and rinse water, wood, and small amounts of asbestos. Navy records, reviewed as part of the performance of an Initial Assessment Study (IAS) in 1982, indicate that the industrial wastes comprise only a small portion of the approximately 4,800 tons of waste that were deposited in this landfill area. Test pits performed at the subject site in 1995 confirmed the findings of the IAS and noted the presence of aged municipal trash including plastic, wood, newspaper, rusted tin cans, oil filters, empty antifreeze bottles, and glass bottles. The municipal trash was noted to be present within two feet of the ground surface. Sandy soils were utilized as cover material over the landfill wastes.

Evidence has also been found that the subject site area had been used for shotgun target practice during some unknown time period. Laboratory analysis of surface soil and sediment samples did not reveal the presence of lead at concentrations that would indicate a significant impact from this activity has occurred.

A description of the on-site soils is presented in Section 3.0 of this SESC Plan Report. The site is currently vegetated with grasses and scrub pines, with the exception of the access road and an open, disturbed, vehicle turn-around area, where no vegetation exists. Since cessation of disposal activities at this site, the sandy soil cover has eroded and portions of the landfill contents have been uncovered.

In 1990, the NWS Earle was placed on the USEPA's National Priorities List (NPL). Several rounds of assessment (human health risks, ecological risks) and investigation (site, remedial, etc.) activities were conducted at the station. Site 3, along with another landfill site (i.e., Site 10) was grouped together, due to similar characteristics into a single operable unit, Operable Unit Six (OU-6). Based on the results of these assessments, investigations and the objective to protect human health and the environment, remedial alternatives to address Site 3 were developed and assessed. A summary of the assessments, investigations and remedial alternative analyses is presented in a document entitled Proposed Plan for Site 3 and 10 (OU-6), Naval Weapons Station Earle, Colts Neck, New Jersey dated May 2001 and prepared by Tetra Tech Nus, Inc.

Based on analysis of the remedial alternatives developed for Site 3, the Department of the Navy, in accordance with the USEPA and the New Jersey Department of Environmental Protection (NJDEP), selected a remedial alternative consisting of the capping of the landfill, the erection of a cable-type wire fence with appropriate warning signs, the establishment of institutional controls (i.e., restrictions attached to the Station Master Plan to limit future use and disturbance of the landfill) and the long term monitoring and maintenance of the landfill surface. The construction of the cap over the landfill area as well as the erection of the cable-type wire fence will act as containment measures serve to restrict human access to the wastes in the landfill area. The institutional controls would limit exposure to the landfills contents.

1.2 SESC Plan Organization

This SESC Plan provides the basis for the establishment of soil erosion and sediment control measures to be implemented at the subjects site during the construction of the chosen remedial alternative (i.e., landfill cap). The SESC Plan describes the proposed measures and procedure for controlling soil erosion at the subject site. The SESC Plan contains the following sections:

- Section 1.0 – INTRODUCTION: This section provides a brief summary of the subject site and the history of the landfill located on same.
- Section 2.0 – PROJECT DESCRIPTION: This section provides a brief description of the remedial activities (i.e., construction activities) to be implemented at the on-site landfill.
- Section 3.0 – EXISTING SITE CONDITIONS: This section of the Soil Erosion and Sediment Control Plan Report details the current conditions at the subject site including a description of the on-site soils and the existing drainage areas.
- Section 4.0 – PROPOSED SITE CONDITIONS: This section of the Soil Erosion and Sediment Control Plan Report details the conditions of the site, including newly established drainage areas, after the construction of the proposed remedial actions (i.e., capping of the on-site landfill).
- Section 5.0 – DRAINAGE AREA COMPARISON (EXISTING VERSUS PROPOSED PEAK FLOWS): This section of the Soil Erosion and Sediment Control Plan Report discusses the comparison of the existing peak flows in each drainage area with the proposed peak flows established after construction of the proposed project. This section also include the rationale for the proposed stabilization methods to be employed to prevent adverse affects to the site and off-site areas from erosional effects.

- Section 6.0 – PROPOSED SOIL EROSION AND SEDIMENT CONTROL MEASURES): This section of the Soil Erosion and Sediment Control Plan Report discusses the proposed soil erosion and sediment control (temporary and permanent) measures to be implemented at the site during the construction activities to prevent adverse effects from erosional forces (i.e., wind, water, etc.).

- Section 7.0 – PROPOSED SEQUENCE OF CONSTRUCTION: This section of the Soil Erosion and Sediment Control Plan Report presents the proposed sequence of construction activities, as well as their durations, to be implemented at the subject site.

- Section 8.0 – REFERENCES: This section of the Soil Erosion and Sediment Control Plan Report presents the references to publications utilized during the preparation of this Soil Erosion and Sediment Control Plan Report as well as the associated Soil Erosion and Sediment Control Plans.

1.3 SESC Plan Preparation

This SESC Plan is being submitted to satisfy the substantive portions of the Standards for Soil Erosion and Sediment Control in New Jersey, adopted July 1999 and the Soil Erosion and Sediment Control Act of 1975 as amended (N.J.S.A. 4:24-39 et. Seq.) and the New Jersey Administrative Code (N.J.A.C. 2:90-1.1 et. seq.)

2.0 PROJECT DESCRIPTION

As previously stated, based on the results of several rounds of assessment, investigation and analysis performed by the Navy, a remedial alternative as stated in the Record of Decision consists of the capping of the existing landfill, construction of a cable-type fence surrounding same, establishment of institutional controls and long term monitoring of the cap has been developed to address the closure of the landfill. The landfill cap will serve to prevent potential human and wildlife contact with the landfill materials, reduce contaminant leaching to groundwater and limit contaminant migration via surface runoff and erosion as stated in the May 2001 Document.

In addition, the perimeter of the landfill will be fenced and warning signs will be posted to limit access to the covered area. Land use restrictions will be placed to limit future uses and development of the site that may result in disturbance of the soil cover or direct contact with contaminated media. These land use restrictions will also prohibit the use of untreated groundwater as drinking water.

The landfill cap design consists of a thirty inch (30") layer of cover soil to be placed over the graded existing soils/wastes. A six inch (6") layer of top soil will be placed over this soil cover layer. The topsoil layer will be hydroseeded to establish permanent vegetative cover.

The cap system consists of an inverted type soil cap. As illustrated on Drawing C-5 of the Soil Erosion and Sediment Control Plans, this type of capping system divides the landfill area into four quadrants. The eastern and western quadrants of the landfill area are sloped towards the eastern and western exteriors of the landfill. A continuous perimeter drainage swale will be constructed around the entire extent of the landfill to collect and transfer stormwater run-off to the existing low lying areas along the southeastern and southwestern corners of the landfill area.

The two interior quadrants are sloped to the center of the landfill area. An interior drainage swale is proposed to be constructed at the base of this slope to collect stormwater runoff from these interior quadrants. The interior swale will serve to collect and transfer stormwater runoff in this area to the low lying areas along the southeastern corner of the landfill area.

3.0 EXISTING SITE CONDITIONS

The former landfill located on the subject site encompasses and area of approximately five (5) acres. The aerial extent of the landfill was determined through the performance of a soil boring program performed by FWENC during site investigation activities in June 2001. The limits of the landfill are shown on a site plan, Figure 3, included in Appendix A of this report.

The subject site is generally bounded to the north, south and west by wooded areas. The eastern side of the subject site is bounded by an existing unnamed road. The areas further to the east, beyond this existing road, consist of undeveloped woodlands. Visual reconnaissance of the subject site notes same to generally slope from north to south. Low lying depressed land areas (i.e., land areas located at a lower elevation than its surrounding areas) are located in the southeastern and southwestern corners of the subject site, outside of the existing landfill limits. Currently, stormwater runoff on the subject site appears to follow the general topography of the subject site and flows in a north to south direction to these low lying areas. The low lying areas appear to collect site stormwater runoff which is directed, via topography, to the undeveloped wooded areas located to the south of the subject site.

A single, thirty-six inch (36"), reinforced concrete stormwater drainage pipe is located in the southeastern corner of the subject site. The location of this pipe is depicted on Figure 3 included in Appendix A of this SESC Plan Report as well as Drawing C-3 of the Soil Erosion and Sediment Control Plans. The pipe extends underneath the existing road to the east of the subject site. Based on a topographic survey of the inverts of the pipe, the pipe collects stormwater from the undeveloped and wooded areas located to the east of the existing road and transfers same, under the existing road, onto the subject site. Stormwater discharge from this pipe empties into the low lying areas located to the southeast of the landfill area. This flow, along with existing site stormwater flow, is directed topographically to the undeveloped wooded areas located to the south of the subject site.

3.1 Critical Areas

Critical areas are those that pose potentially serious soil erosion problems due to the presence of steep slopes, poor vegetative cover or potentially high surface water velocities. Currently, no potentially critical areas are noted to exist on the subject site.

3.2 Wetlands

A site reconnaissance was performed by a representative of FWENC on June 6, 2001 to confirm the presence/absence of wetland areas within the site limits. Field conditions at the time of the site reconnaissance noted the site to consist primarily of a forested area over sandy fill materials. Vegetation on the site was noted to consist of pitch pines, red oak species, black cherry saplings and black huckleberrys. The on-site soils were determined not to be hydrophytic. Soils were noted to consist of a grayish brown sandy surface layer over yellowish brown sand and were determined to be non-hydric. No evidence of wetland hydrology was observed within the limits of Site3. Therefore, Site 3 was determined to be non-wetland.

3.3 Flood Plains

Based on review of available information as well as data gained during site investigation/site reconnaissance activities, no portions of Site 3 are located within the 100-year flood plain area.

3.4 On-Site Soils

Review of the Soil Survey of Monmouth County, New Jersey dated 1989, as prepared by the United States Department of Agriculture (USDA), Soil Conservation Service, notes the presence of a single soil series (i.e., the Lakehurst series) to be underlying the subject site. The limits of this soil series, as it appears on the subject site, is depicted on a site plan, Figure 4, included in Appendix A of this SESC Plan Report.

The Lakehurst series soils, mapped as Lakehurst sand are nearly level, moderately well drained and somewhat poorly drained soil in depressional areas and on low divides. Typically, the surface layer is gray sand 4 inches thick. The subsurface layer is light gray sand 6 inches thick. The subsoil is 26 inches thick. It is brown loamy sand to a depth of 13 inches. In the next layer it is mottled, brownish yellow sand to a depth of 24 inches. Below that, it is mottled, pale brown sand to a depth of 36 inches. The substratum is mottled, light brownish gray sand to a depth of 60 inches or more. Permeability of this Lakehurst soil is rapid in the subsoil and the substratum. The available water capacity is low. The apparent seasonal high water table depth of 1 ½ to 3 ½ feet from January to April. Runoff is very slow. Water erosion is a slight hazard. Wind erosion is a severe hazard. Most areas of this soil consist of woodlands. A very small acreage is used for pasture and farming. This soil is poorly suited to common field crops, hay, and vegetables. The main limitations are the low available water capacity, the low organic matter content, rapid permeability, and the seasonal high water table. The main limitations to use of this soil as sites for dwellings and some other types of community development are the seasonal high water table, poor filter, cutbanks caving, and sandiness.

3.5 Existing On-Site Drainage Areas

Based on review of topographical maps, site surveys and other information concerning the subject site, it appears that with the exception of the aforementioned 36" diameter stormwater drainage pipe, the site is isolated from off-site drainage flow patterns. The site is bounded to the north and west by natural drainage divides (i.e., mounded areas) which would prevent stormwater run-on from the undeveloped wooded areas to the north and west to the subject site. The existing road to the east of the site serves to prevent stormwater run-on from area to the east of the subject site. The general topography of the subject site (i.e., sloping from north to south) prevents stormwater run-on from the undeveloped wooded areas located to the south of the subject site.

Based on the existing topography of the subject site, the site consists primarily of two drainage areas that generally divide the site into eastern and western portions. The first drainage area (i.e., EDA-1) is located in the eastern portion of the site and includes the stormwater flow from the eastern portion of the existing landfill as well as the flow transferred through the existing 36" reinforced concrete pipe (RCP). Overland stormwater flow from the landfill area is directed to the southeastern corner of the subject site (located to the southeast of the landfill limits). Stormwater collected in this low lying area is directed, via land topography, in a southeasterly

direction and joins the flow from the single 36" RCP. At this point, the stormwater flow combines with other overland flow and is directed, via existing topography, to the undeveloped wooded areas located to the southeast of the subject site. EDA-1 encompasses an area of approximately 290,319 square feet (sq. ft.).

The second drainage area (i.e., EDA-2) is located in the western portion of the subject site and includes the stormwater flow from western portion of the existing landfill. Flow in this drainage area is directed, in a southwesterly direction, via existing land topography, to the undeveloped wooded areas located to the southwest of the subject site. EDA-2 encompasses an area of approximately 211,968 sq. ft.

The approximate limits of the two existing drainage areas (i.e., EDA-1 and EDA-2) as well as their associated discharge points (Q_1 and Q_2, utilized in the stormwater management calculations) are depicted on a site plan, Figure 5, included in Appendix A of this report.

3.6 Existing On-Site Peak Flows

Utilizing the existing drainage area information, the existing conditions located on the site and the USDA, National Resource Conservation Service, Urban Hydrology for Small Watersheds, Technical Release 55 (TR-55), the peak discharge flows for each drainage areas were calculated. The flows were calculated utilizing the two (2), ten (10) and twenty-five (25) year storm events. The following table summarize the peak flows in each drainage area for each of the storm events.

Drainage Area Number	Acreage (sq. ft.)	Peak Flows (cubic feet per second (cfs))		
		Two Year Storm	Ten Year Storm	Twenty-Five Year Storm
EDA-1 (*)	290,319	65.75	69.65	71.69
EDA-2	211,968	1.68	4.66	6.11

* Drainage area EDA-1 includes the maximum stormwater flow from the aforementioned 36" stormwater pipe (i.e., the pipe flowing full).

Please note, all calculations performed to develop these flows including TR-55 Worksheet 2: Runoff Curve Numbers and Runoff, Worksheet 3: Time of Concentration (T_c) or Travel Time (T_t) and Worksheet 4: Graphical Peak Discharge Method are included in Appendix B of this SESC Plan. In addition, the calculation regarding the 36" stormwater pipe, which directs stormwater onto the subject site, is included in Appendix B. It should be noted, for the purposes of calculating the flow from this pipe, the pipe was considered to be flowing full which would be the worst case scenario in any storm event that could be realized from the pipe.

4.0 PROPOSED SITE CONDITIONS

Implementation of the proposed remedial actions (i.e., capping of the landfill site) will result in the clearing and grubbing of existing vegetation, the installation of soil coverings not indigenous to the subject site (i.e., placement of common fill, top soil and the establishment of permanent vegetative cover) and the establishment of new drainage areas. The proposed grading of the subject site after the construction of the soil cap and associated stormwater swales in shown on Drawing C-5 of the Soil Erosion and Sediment Control Plan.

4.1 Critical Areas

The implementation of the proposed remedial actions will create two new critical areas located at the discharge points of the drainage swales. Conduit outlet protection consisting of horizontal rip-rap aprons has been designed to prevent erosion problems stemming from these discharges. A discussion of the design of the aprons is presented in Section 6.5 of this SESC Plan Report. Details of the apron design are also presented on Sheet C-6 of the Soil Erosion and Sediment Control Plans.

4.2 Proposed On-Site Drainage Areas

Based on proposed topography for the subject site, the site will be divided into a total of three drainage areas. The limits of the three drainage areas (i.e., PDA-1, PDA-2 and PDA-3) are depicted on a site plan, Figure 6, included in Appendix A of this report.

Generally, stormwater flow from drainage areas PDA-1 and PDA-2 will be collected in perimeter swales and directed to the low lying areas located in the southeastern and southwestern corners of the subject site, similar to the existing site conditions. Stormwater from drainage area PDA-3 (i.e., the interior drainage area) will be collected in the interior drainage swale. The interior drainage swale will flow in a north-south direction to the southern limit of the landfill area. From this point, the swale will flow in a southeastern direction and join with the flow from drainage area PDA-1 and its associated swale. At this point, the combined flow will discharge into the low lying area located in the southeastern corner of the subject site.

The drainage swales are proposed to be constructed with trapezoidal sections. The section is proposed to have a base width of two feet (2') with side slopes of 3H:1V. Based on the stormwater calculations performed, the swales will have a design depth of two feet (2'). The design slope will be 1%. Details of the construction of the swales are shown on Drawing C-6 of the Soil Erosion and Sediment Control Plans.

It should be noted, a depiction of the approximate limits of the proposed drainage areas (PDA-1 through PDA-3) as well as the locations of the proposed interior and exterior drainage swales and their associated discharge points are shown on Figure 6, included in Appendix A of this SESC Plan Report as well as Drawings C-4 and C-5 of the Soil Erosion and Sediment Control Plans.

4.3 Proposed On-Site Peak Flows

Utilizing the proposed conditions drainage area information, the proposed conditions located on the site and the USDA, National Resource Conservation Service, Urban Hydrology for Small

Watersheds, Technical Release 55 (TR-55), the peak discharge flows for each of the proposed drainage areas were calculated. The flows were calculated utilizing the two (2), ten (10) and twenty-five (25) year storm events. The following table summarizes the peak flows in each drainage area for each of the storm events.

Drainage Area Number	Acreage (sq. ft.)	Peak Flows (cubic feet per second (cfs))		
		Two Year Storm	Ten Year Storm	Twenty-Five Year Storm
PDA-1 (*)	198,654	65.00	67.72	69.31
PDA-2	180,489	1.39	4.01	5.43
PDA-3	133,182	0.84	2.89	3.95

* Drainage area PDA-1 includes the maximum stormwater flow from the aforementioned 36" stormwater pipe (i.e., the pipe flowing full).

Please note, all calculations performed to develop the proposed peak discharges including TR-55 Worksheet 2: Runoff Curve Numbers and Runoff, Worksheet 3: Time of Concentration (T_c) or Travel Time (T_t) and Worksheet 4: Graphical Peak Discharge Method are included in Appendix B of this SESC Plan.

5.0 DRAINAGE AREA COMPARISON (EXISTING VERSUS PROPOSED PEAK FLOWS)

To determine the need for stabilization of the three on-site drainage areas and the two discharge points (PDA-1 and PDA-3 discharge to the same point) and their associated land depressions, a comparison of the existing versus proposed conditions was performed. Based on the information presented in Sections 3.0 and 4.0 of this report, the peak flows calculated for the existing site conditions in each of the three on-site drainage areas, is equal to or exceeds the peak flow in the same drainage areas during the proposed conditions. The following table summarizes this comparison.

Drainage Area Number	Acreage (sq. ft.)	Peak Flows (cubic feet per second (cfs))		
		Two Year Storm	Ten Year Storm	Twenty-Five Year Storm
EDA-1/ PDA-1+PDA-3 (*)	290,319 / 331,836	65.75 / 65.84	69.65 / 70.61	71.69 / 73.26
EDA-2 / PDA-2	211,968 / 180,489	1.68 / 1.39	4.66 / 4.01	6.11 / 5.43

(*) The flows from drainage areas PDA-1 and PDA-3 are collected by separate stormwater drainage swales. These flows ultimately combine in a single discharge point located in the southeastern corner of the subject site.

As shown in the above table, a comparison of the peak flows under the existing conditions with the peak flows under the proposed site conditions reveals basically no change in the peak flows to the two site discharge points. The first site discharge point (i.e., Q_1) is subject to flows from existing drainage area EDA-1 of 65.75 cfs, 69.65 cfs and 71.69 cfs, respectively during the two, ten and twenty-five year storms. Under the proposed conditions, this discharge point will be subject to a combined flow from proposed drainage areas PDA-1 and PDA-3 of 65.84 cfs, 70.61 cfs and 73.26 cfs, respectively during the two, ten and twenty-five year storms. The change in site conditions will represent a 0.014%, 1.36% and 2.1% during the two, ten and twenty-five year storms. These percentages represent an insignificant change in site flows between the existing and proposed site conditions. Further, it should be noted, all areas located downgradient of Site 3 that will be subject to this insignificant increase in stormwater flow, consist of undeveloped wooded areas owned by the Department of the Navy.

The second site discharge point (i.e., Q_2) is subject to flows from existing drainage area EDA-2 of 1.68 cfs, 4.66 cfs and 6.11 cfs, respectively during the two, ten and twenty-five year storms. Under the proposed conditions, this discharge point will be subject to flows of from proposed drainage area PDA-2 of 1.39 cfs, 4.01 cfs and 5.43 cfs, respectively during the two, ten and

twenty-five year storms. Comparing the existing and proposed conditions notes that the construction of the proposed soil cap will decrease the off-site flows at this discharge point.

Based on the above, it does not appear that the use of any stormwater management basins are necessary to control the rate of stormwater flow from the site. Further, based on the comparison of the existing and proposed peak flows, no enhancements of the low lying areas or downstream points are warranted.

However, based on the fact that the implementation of the proposed remedial alternative will disturb a land area in excess of 5,000 sq. ft. and that the proposed site conditions will concentrate the flow at the two site discharge points (Q_1 and Q_2), soil erosion and sediment control measures, as per the Standard for Soil Erosion in New Jersey dated July 1999, will be employed during the construction and maintenance activities. These soil erosion and sediment control measures are discussed in the following section of this report and detailed on the Soil Erosion and Sediment Control Plans.

6.0 PROPOSED SOIL EROSION AND SEDIMENT CONTROL MEASURES

Based on the need to minimize soil erosion during the implementation of the project as well as in the long term, the following soil erosion and sediment control measures will be utilized. It should be noted, the locations of the various erosion control measures are depicted on the attached Soil Erosion and Sediment Control Plans.

6.1 Temporary Vegetative Cover for Soil Stabilization

To minimize erosional (wind, water, etc.) effects during the implementation of the proposed remedial actions, all soils exposed for periods of two (2) to six (6) months, not subject to grading, construction activities or scheduled for permanent seeding, will be temporarily seeded until permanent stabilization can be established. Temporary seeding activities will be conducted as per Standard 7-1 of the Soil Erosion and Sediment Control Standards (July 1999) as well as per the Temporary Seeding specifications on Drawing C-2 of the Soil Erosion and Sediment Control Plans.

6.2 Permanent Vegetative Cover for Soil Stabilization

As previously indicated, the establishment of permanent vegetative covers is the final component of the proposed landfill cap. Permanent seeding will be performed as per Standard 4-1 of the Soil Erosion and Sediment Control Standard in New Jersey dated July 1999 and as per the notes and details on Drawing C-2 of the Soil Erosion and Sediment Control Plans. However, it should be noted that the Department of the Navy maintains their own specification regarding seed mixtures for permanent seeding. This mixture is presented on Drawing C-2 of the Soil Erosion and Sediment Control Plans.

6.3 Top Soil

As previously stated, the final layer of the proposed landfill cap will consist of a six (6) inch layer of top soil. The top soil will be placed and permanently seeded as per the technical specification for the project, all applicable sections of the Standard for Soil Erosion and Sediment Control in New Jersey and the notes and details presented on the Soil Erosion and Sediment Control Plans for this project.

6.4 Channel Stabilization

As previously stated, the implementation of the proposed project includes the construction of two perimeter (eastern and western) swales and one interior drainage swale. These swales will have a trapezoidal section with a base of two feet (2'), side slopes of 3:1 and a depth of two feet (2').

TR-55 and other stormwater calculations were performed to size the swales based on the peak flows generated from the stormwater calculations in the drainage areas. These calculations are included in Appendix B of this SESC Plan Report. Based on these calculations, it was determined that a maximum peak flow of 9.80 cfs ($Q_1 + Q_3$) would be realized in the swales (i.e., the eastern perimeter swale) during a twenty-five (25) year

storm event. Utilizing this flow and the cross sectional area of the swale (i.e., sixteen (16) square feet), the maximum velocity in the swale would be 0.62 feet/second (ft/s).

Utilizing Table 11-1 of the Standards for Soil Erosion and Sediment Control in New Jersey, the maximum allowable velocity for sand type soils is 1.8 ft/s. This value also represents the most conservative velocity. As the maximum velocity which would be realized in the proposed swales is 0.62 ft/s and Standard 11-1 allows for a permissible velocity of 1.8 ft/s, it does not appear that any of the three swales will require any additional stabilization measures besides the permanent seeding of same.

6.5 Conduit Outlet Protection

As previously stated in this SESC Plan Report, the three stormwater swales to be constructed on the subject site will discharge to low lying areas, located on the southeastern and southwestern corners of the site, via two discharge points (i.e., Q_1 and Q_2). In order to protect these discharge points from erosional forces, the two discharge points will be equipped with conduit outlet protection. The conduit outlet protection will consist of horizontal aprons constructed of rip-rap with a D_{50} size of three inches (3"). The thickness of the aprons will be nine inches (9") for the Q_1 discharge point and six inches (6") for the Q_2 discharge point. Calculations associated with the sizing of the horizontal aprons are included in Appendix A of this SESC Plan Report. Details concerning the size and construction of the aprons are shown on Drawing C-6 of the Soil Erosion and Sediment Control Plans.

6.6 Dust Control

As stated in the Standards for Soil Erosion and Sediment Control in New Jersey, dated July 1999, to prevent blowing and movement of dust from exposed soil surfaces and to reduce on-site and off-site damage and health hazards during construction activities, dust control methods will be utilized as per Standard 16-1. The Contractor will be required to implement one or more of the dust control methods as per the notes on Drawing C-2 of the Soil Erosion and Sediment Control Plans.

6.7 Grassed Waterway

As previously stated, three drainage swales are proposed to be constructed at the subject site to collect stormwater runoff from the landfill area and direct same to the low lying areas in the southeastern and southwestern corners of the subject site. The design of these swales satisfied the substantive portions of the Grassed Waterway Standard. The swales will have trapezoidal sections and be subject to permanent seeding as per the Standard for Permanent Vegetative Cover for Soil Stabilization (Standard 4-1). The swales will have a base dimension of two feet (2') and side slopes of 3:1. Based on the design depth of two feet (2'), the top width of the waterway will be fourteen feet (14') which exceeds the minimum width of ten feet (10'). Based on the maximum velocity that will be realized in the swale (0.62 ft/s as discussed in Section 6.4 of this report), the swale design satisfies the maximum allowable velocities for grassed waterways as specified in Table 18-1 (i.e., maximum of 2.0 ft/s in sand soils).

6.8 Silt Fence

Silt fencing will be installed along the perimeter of the site immediately adjacent to the limits of disturbance as shown on Drawing C-4 of the attached Soil Erosion and Sediment Control Plan. The fencing will be installed in order to intercept runoff from the disturbed areas and prevent silt from migrating off-site with same. The silt fence will be installed prior to any clearing, grubbing, or excavation activities at the site. The silt fence will be installed as per Standard 25-1 as well as the notes and details presented on Drawing C-2.

6.9 Stabilized Construction Accessway

Access to the subject site is via a dirt road extending from the existing road located to the east of the subject site. The location of this access road is depicted on Figure 3 included in Appendix A of this report. As such, to reduce tracking or flowing of sediment onto the existing road, a stabilized construction accessway will be constructed at the site entrance. The accessway will be constructed as per Standard 29-1 and the notes and details on Drawing C-2 of the Soil Erosion and Sediment Control Plans.

6.10 Decontamination Pad

A decontamination pad will be constructed adjacent to the stabilized construction accessway. The pad will be of similar construction to the stabilized construction accessway and will be utilized to remove all soils and sediments from site vehicles prior to same exiting the site. A detail noting the construction of the proposed decontamination pad is included in Drawing C-2 of the Soil Erosion and Sediment Control Plans.

6.11 Best Management Practices

The following management practices will be applied throughout the construction activities:

1. Unstabilized, disturbed areas will be minimized and construction activities will be staged.
2. Seeding or other stabilization measures will follow immediately after grading.
3. Areas, which are not to be disturbed, will be clearly marked by flags, signs, etc.
4. The Navy's Contracting Officer will be responsible for ensuring the installation and maintenance of all soil erosion and sediment control practices.
5. Erosion and sediment control structures will be installed and/or constructed prior to the start of any earth disturbing activities.
6. Erosion and sediment control structures will remain in place until permanent vegetation has become established over disturbed surface.

6.12 Maintenance of Soil Erosion and Sediment

In general, all erosion and sediment control measures will be checked daily and after each significant rainfall event. Any required repairs will be made immediately. The following items will be checked in particular:

- The stabilized construction accessway and the decontamination pad will be maintained in a condition, including the addition of stone or other repairs, which will minimize tacking of sediment onto roads.
- The silt fence will be checked regularly for undermining or deterioration of the fabric. Sediment will be removed when the level of sediment deposition reaches half of the height of the fabric.
- All seeded areas will be checked regularly to ensure that a good stand is maintained. Areas shall be fertilized, additional top soil placed and re-seeded as needed.

7.0 SEQUENCE OF CONSTRUCTION

The proposed Sequence of Construction is detailed in the following table as well as on Drawing C-1 of the Soil Erosion and Sediment Control Plan:

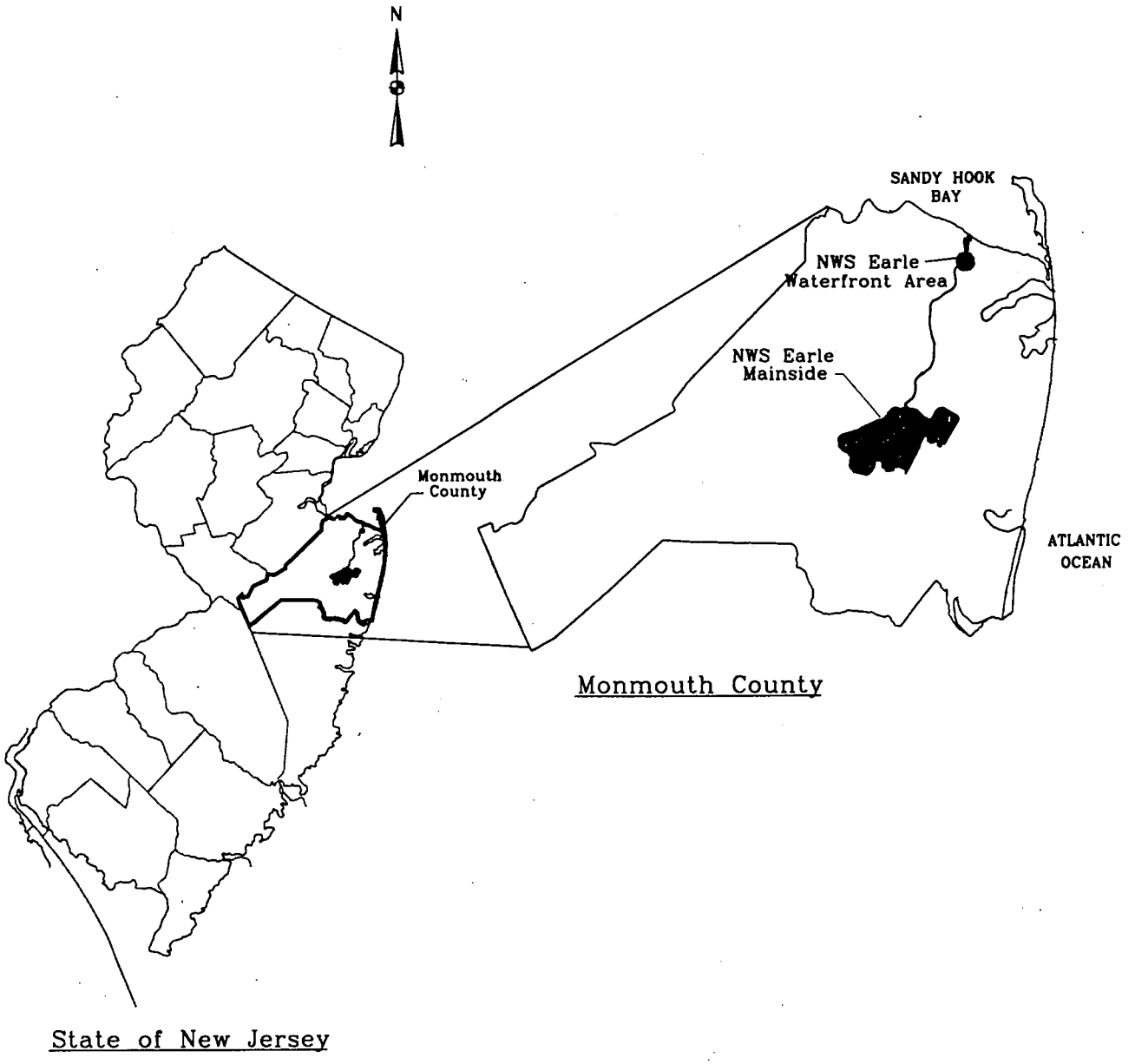
Task		Duration (Working Days)
(1)	Mobilize Site	5
(2)	Sweep of Work Area for Unexploded Ordinances	5
(3)	Install Soil Erosion and Sediment Control Measures	10
(4)	Clearing and Grubbing of Site within Limits of Disturbance	5
(5)	Perform Test Pit Operations/Conduct Site Survey	10
(6)	Construct/Stabilize Temporary Site Access Roads	5
(7)	Place and Grade Subgrade	10
(8)	Construct Landfill Cap	20
(9)	Construct Permanent Security Fencing	5
(10)	Seed Site/Conduct Final Site Survey	10
(11)	Demobilize Site / Remove Soil Erosion and Sediment Control Measures	3
TOTAL		**88 Working Days**

8.0 REFERENCES

New Jersey State Soil Conservation Committee, 1999. "Standards for Soil Erosion and Sediment Control in New Jersey."

APPENDIX A

FIGURES

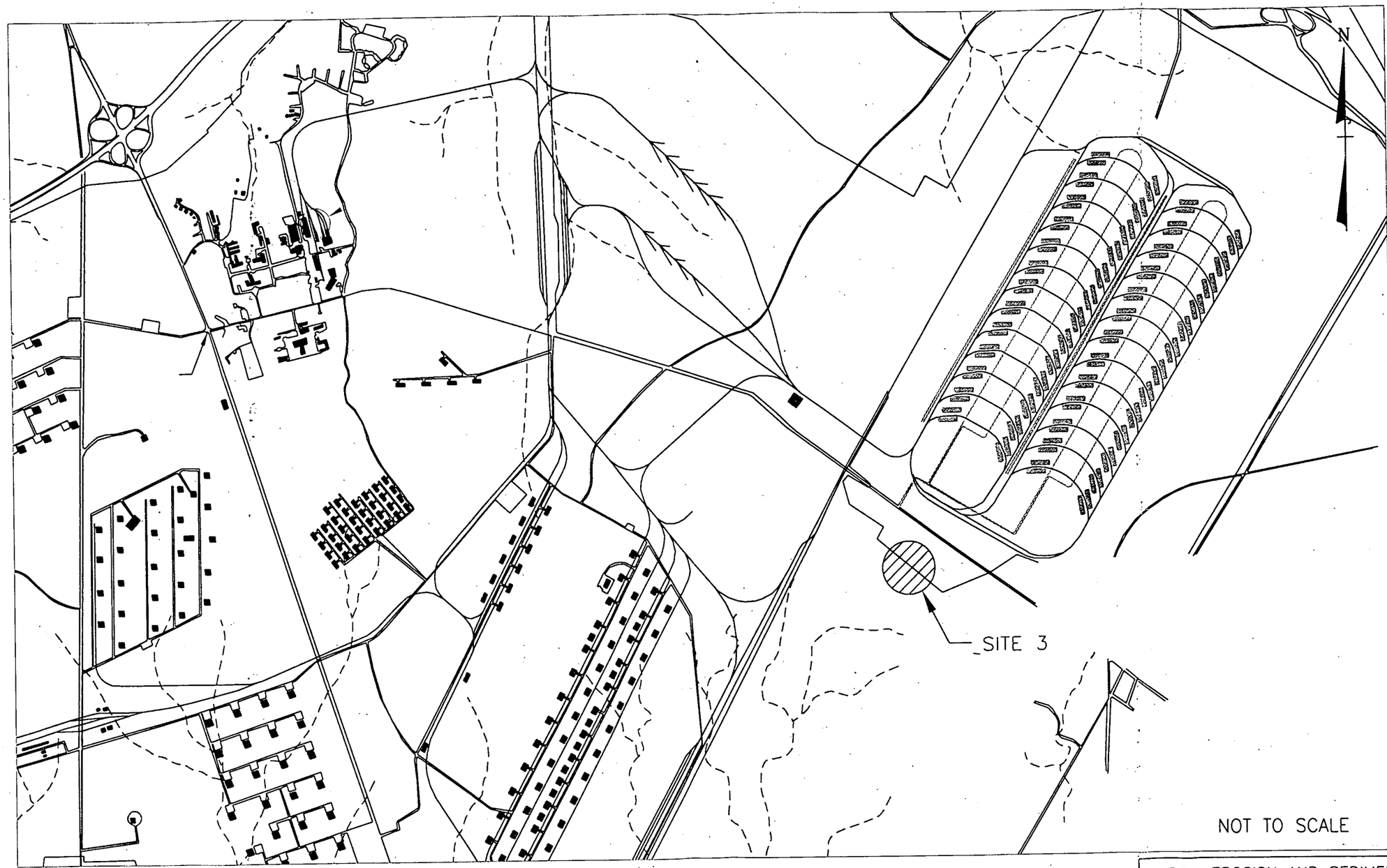


NOT TO SCALE

SOIL EROSION AND SEDIMENT CONTROL PLAN
NAVAL WEAPONS STATION EARLE – SITE 3

FIGURE 1
SITE LOCATION MAP
NAVAL WEAPONS STATION EARLE

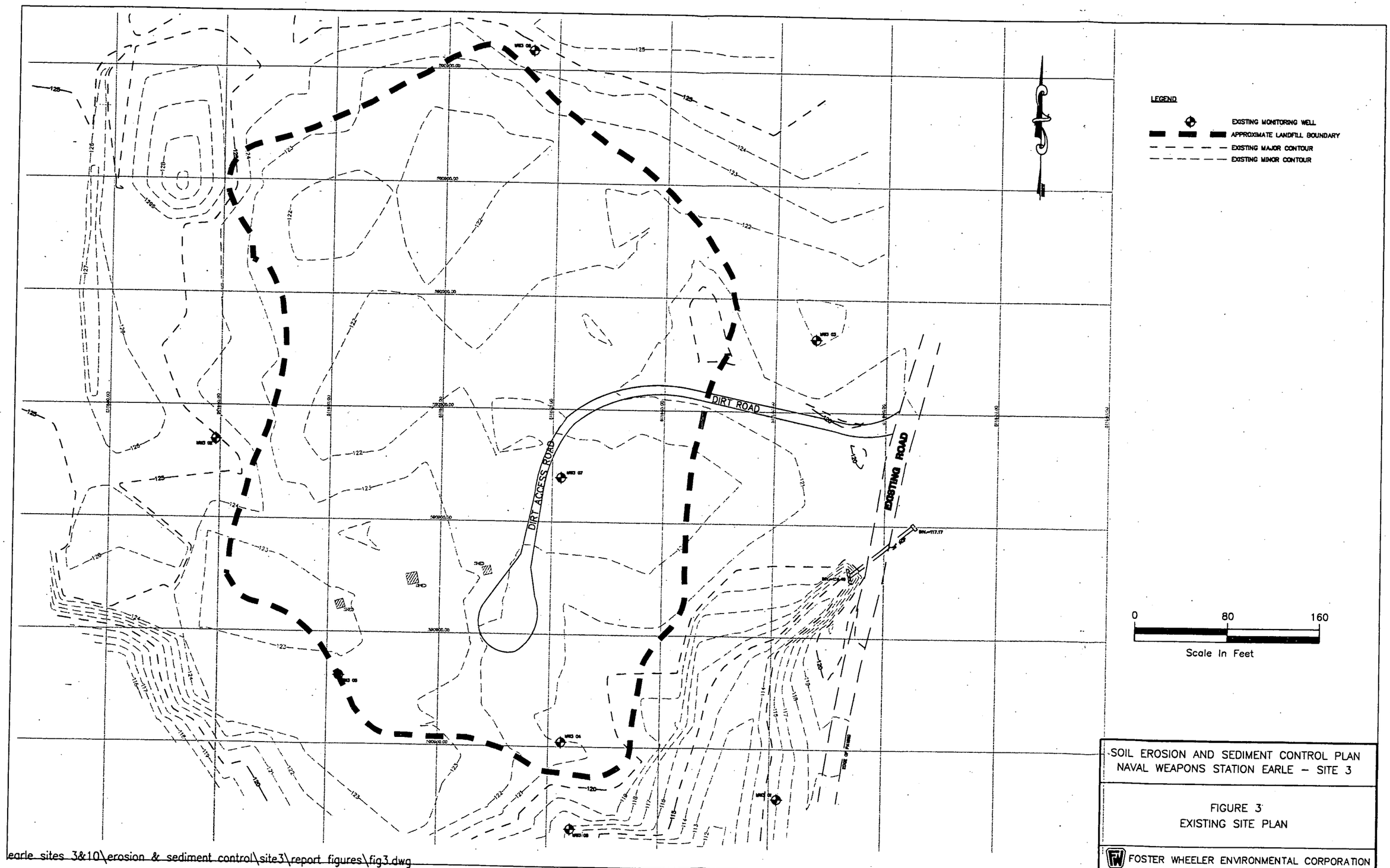
FOSTER WHEELER ENVIRONMENTAL CORPORATION



SOIL EROSION AND SEDIMENT CONTROL PLAN
NAVAL WEAPONS STATION EARLE – SITE 3

FIGURE 2
SITE LOCATION MAP – SITE 3

FOSTER WHEELER ENVIRONMENTAL CORPORATION



SOIL EROSION AND SEDIMENT CONTROL PLAN
NAVAL WEAPONS STATION EARLE – SITE 3

FIGURE 3
EXISTING SITE PLAN

FOSTER WHEELER ENVIRONMENTAL CORPORATION

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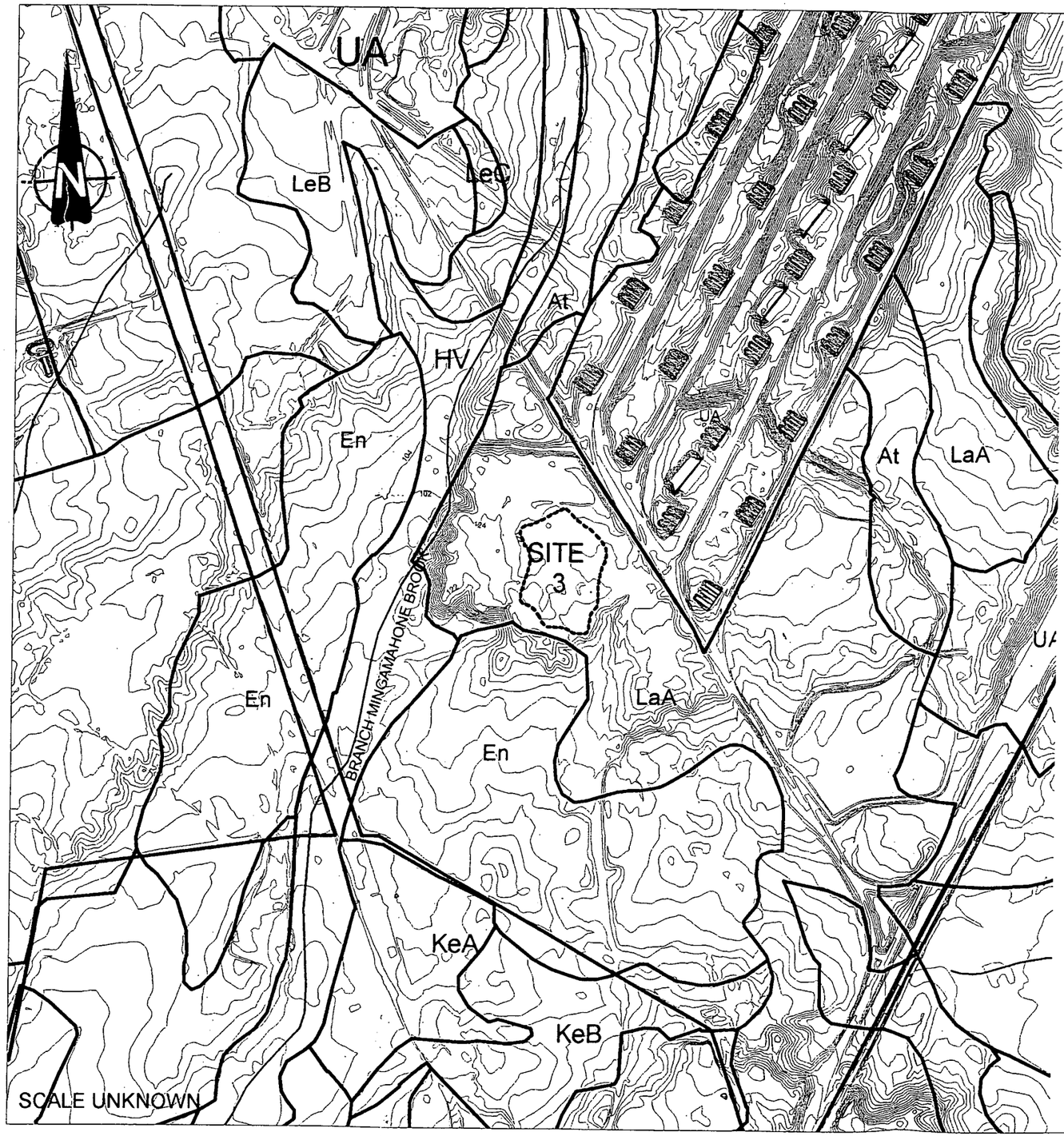


Legend

At - Atsion sand. Nearly level, poorly drained soil in depressional areas and on broad flats. Permeability of the Atsion soil is moderately rapid or rapid in the subsoil and rapid in the substratum.

En - Elkton loam. Nearly level, poorly drained soil in depression areas and broad flats. Permeability of this Elkton soil is slow in the subsoil and moderately slow to moderately rapid in the substratum. The available water capacity is high. Runoff is slow. Erosion is a slight hazard.

HV - Humaquepts, frequently flooded.
Nearly level, somewhat poorly drained to very poorly drained soils.
They are on flood plains along perennial and intermittent streams.
These soils differ greatly from place to place. Permeability of Humaquepts, frequently flooded, is moderate or moderately rapid in the subsoil and the substratum.

LaA- Lakehurst sand, 0 to 2 percent slopes.
This is a nearly level, moderately well drained and somewhat poorly drained soil in depressional areas and on low divides.
Permeability of this Lakehurst soil is rapid in the subsoil and the substratum.

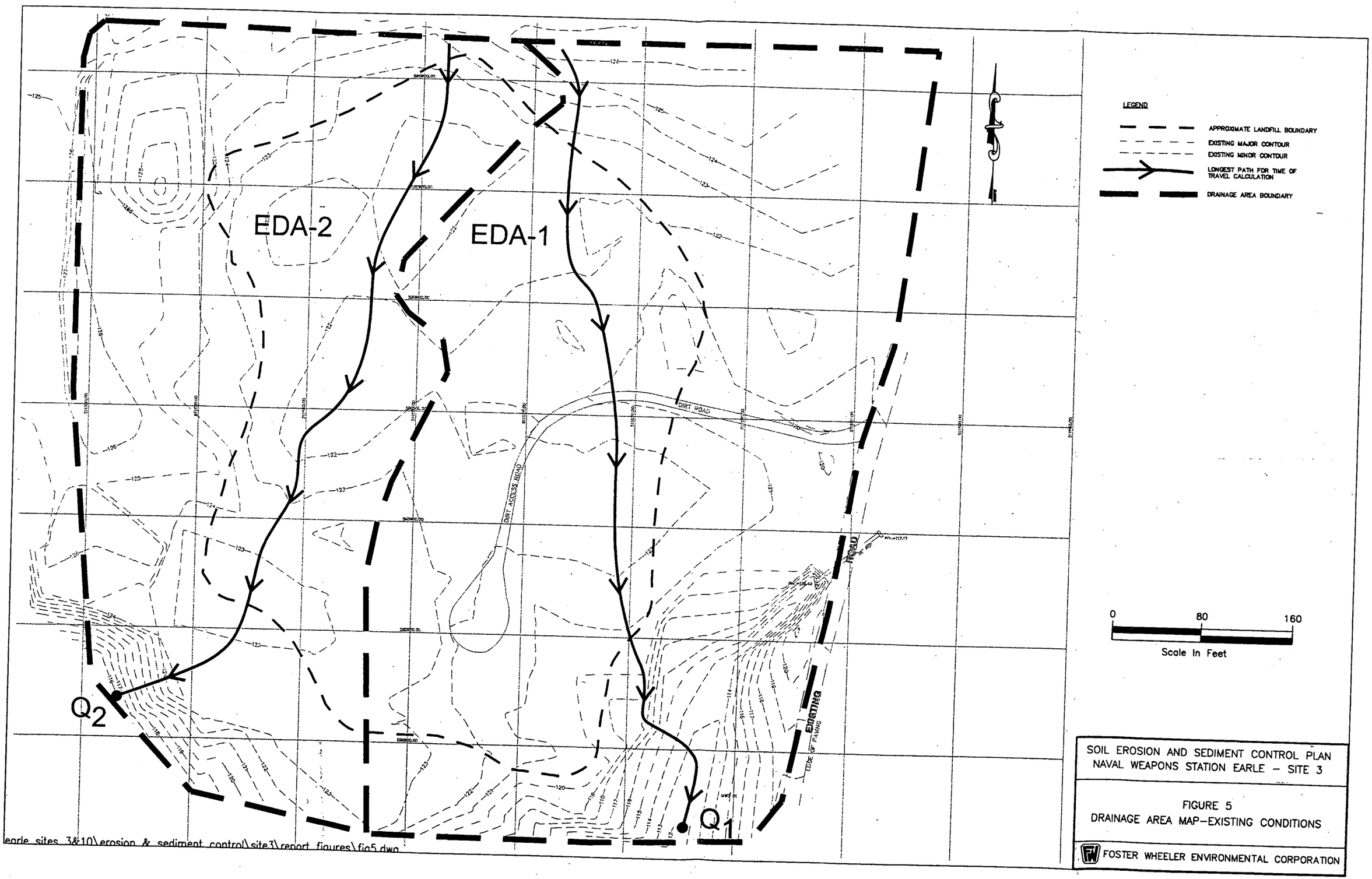
UA - Udorthents, smooth.
This soil unit consists of areas of soil that have been altered by excavating or filling.
The properties of this soil difffer from place to place. Onsite investigation and evaluation are needed for most uses.

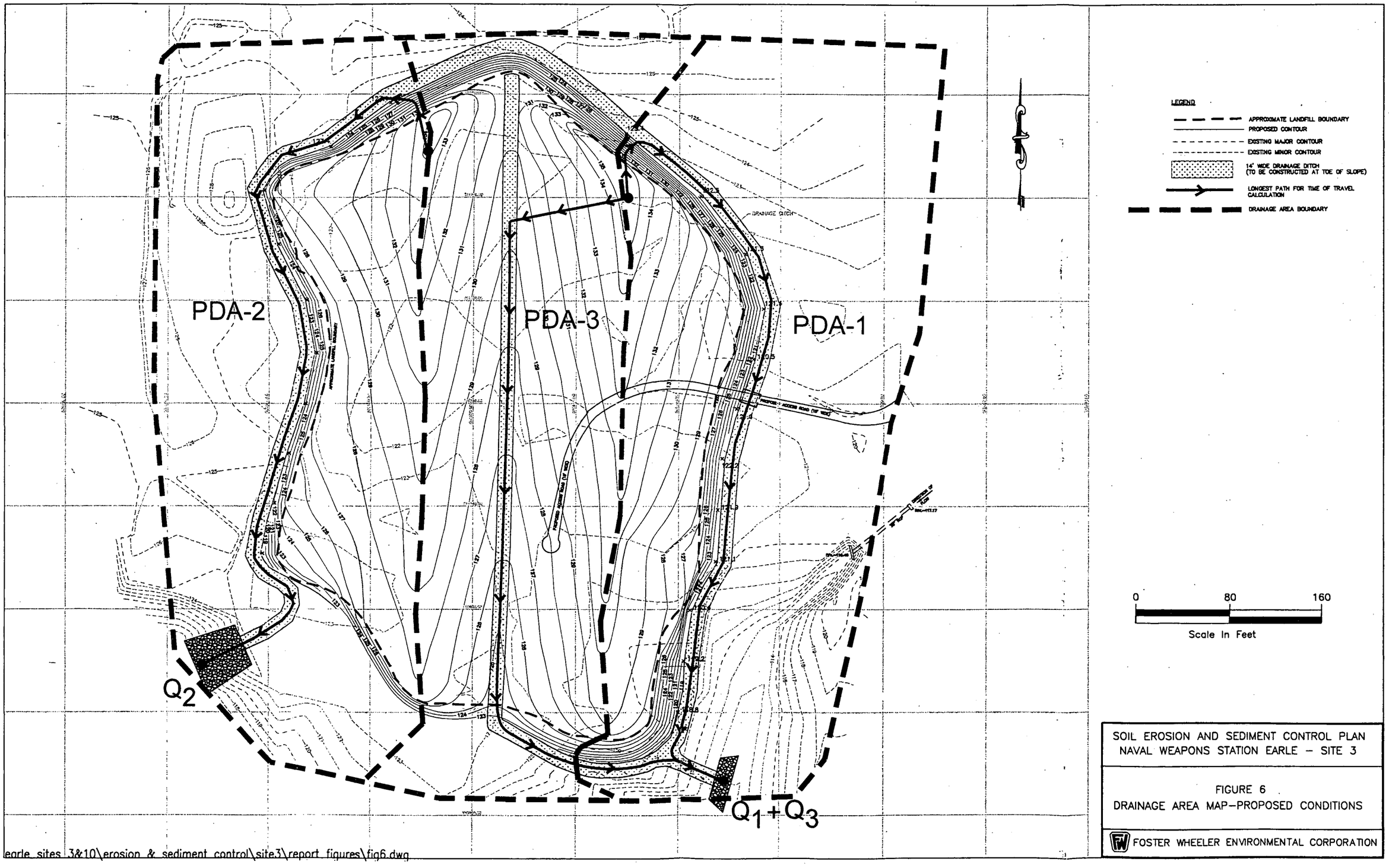
Source: USDA, Soil Conservation Service,
"Soil Survey of Monmouth County, New Jersey".

SOIL EROSION AND SEDIMENT CONTROL PLAN
NAVAL WEAPONS STATION EARLE - SITE 3

FIGURE 4
SOILS MAP

FOSTER WHEELER ENVIRONMENTAL CORPORATION


EDA-2
EDA-1
Q2
Q1
DIRT ROAD
DIRT ACCESS ROAD
EXISTING
EDGE OF PAVING
LEGEND
APPROXIMATE LANDFILL BOUNDARY
EXISTING MAJOR CONTOUR
EXISTING MINOR CONTOUR
LONGEST PATH FOR TIME OF TRAVEL CALCULATION
DRAINAGE AREA BOUNDARY
0
80
160
Scale In Feet
SOIL EROSION AND SEDIMENT CONTROL PLAN
NAVAL WEAPONS STATION EARLE – SITE 3
FIGURE 5
DRAINAGE AREA MAP–EXISTING CONDITIONS
FOSTER WHEELER ENVIRONMENTAL CORPORATION
earle sites 3&10\erosion & sediment control\site3\report figures\fig5.dwg


LEGEND
APPROXIMATE LANDFILL BOUNDARY
PROPOSED CONTOUR
EXISTING MAJOR CONTOUR
EXISTING MINOR CONTOUR
14' WIDE DRAINAGE DITCH (TO BE CONSTRUCTED AT TOE OF SLOPE)
LONGEST PATH FOR TIME OF TRAVEL CALCULATION
DRAINAGE AREA BOUNDARY
PDA-1
PDA-2
PDA-3
Q_2
Q_1+Q_3
DRAINAGE DITCH
0
80
160
Scale In Feet
SOIL EROSION AND SEDIMENT CONTROL PLAN
NAVAL WEAPONS STATION EARLE – SITE 3
FIGURE 6
DRAINAGE AREA MAP–PROPOSED CONDITIONS
FOSTER WHEELER ENVIRONMENTAL CORPORATION
earle sites 3&10\erosion & sediment control\site3\report figures\fig6.dwg

APPENDIX B

STORMWATER CALCULATIONS

Worksheet 2: Runoff curve number and runoff

Project	By	Date
Navy - Earle	DMM	8/3/01
Location	**Checked**	**Date**
Site 3 - Q1 (area EDA1)	KJB	8/13/01

Check one: ☒ Present ☐ Developed

1. Runoff curve number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Figure 2-3	CN 1/ Figure 2-4	Area ☒ acres ☐ mi² ☐ %	Product of CN x area
Lakehurst Sand (B)	Woods - Grass Combination (Area = 290,319 ft²)	65			6.66	432.9
					Totals ➡	6.66	432.9

1/ Use only one CN source per line

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{432.9}{6.66} = 65$; Use CN ➡ 65

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr	2	10	25
Rainfall, P (24-hour)	in	3.5	5.25	6.0
Runoff, Q	in	0.75	1.82	2.35

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

$$S = \frac{1000}{CN} - 10 = \frac{1000}{65} - 10 = 5.38$$

2 yr storm

$$Q = \frac{(P - 0.2S)^2}{P + 0.8S} = \frac{[3.5 - (0.2)(5.38)]^2}{3.5 + 0.8(5.38)} = \frac{5.88}{7.80} = 0.75$$

10 yr storm

$$Q = \frac{[5.25 - (0.2)(5.38)]^2}{5.25 + 0.8(5.38)} = \frac{17.42}{9.55} = 1.82$$

25 yr storm

$$Q = \frac{[6.0 - (0.2)(5.38)]^2}{6.0 + 0.8(5.38)} = \frac{24.25}{10.30} = 2.35$$

Worksheet 3: Time of Concentration (T_c) or travel time (T_t)

Project	By	Date
Navy – Earle	DMM	8/3/01
Location	**Checked**	**Date**
Site 3 – Q1 (area EDA1)	KJB	8/13/01

Check one: ☒ Present ☐ Developed

Check one: ☐ T_c ☐ T_t through subarea

Notes: Space for as many as two segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow: (Applicable to T_c only)

	Segment ID	AB	
1.	Surface description (table 3-1)	Dense Grass	
2.	Manning's roughness coefficient, n (table 3-1)	0.25	
3.	Flow length, L (total L ≠ 300 ft) ft	299	
4.	Two-year 24-hour rainfall, P_2 in	3.5	
5.	Land slope, s ft/ft	0.017	
6.	$T_t = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_t hr	0.60 +	= 0.60

	Segment ID	BC	
7.	Surface description (paved or unpaved)	Unpaved	
8.	Flow length, L ft	446	
9.	Watercourse slope, s ft/ft	0.020	
10.	Average velocity, V (figure 3-1) ft/s	2.1	
11.	$T_t = \frac{L}{3600\,V}$ Compute T_t hr	0.059 +	= 0.059

Channel flow:

	Segment ID		
12.	Cross sectional flow area, a ft^2		
13.	Wetted perimeter, p_w ft		
14.	Hydraulic radius, $r = \frac{a}{p_w}$ Compute r ft		
15	Channel slope, s ft/ft		
16.	Manning's roughness coefficient, n		
17.	$V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V ft/s		
18.	Flow length, L ft		
19.	$T_t = \frac{L}{3600\,V}$ Compute T_t hr	+	=

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) Hr 0.66

Worksheet 4: Graphical Peak Discharge method

Project	By	Date
Navy - Earle	DMM	8/3/01
Location	**Checked**	**Date**
Site 3 - Q1 (Area EDA 1)	KJB	8/13/01

Check one: [X] Present [ ] Developed

1. Data

Drainage area ..... A_m = 0.010 mi² (acres/640)

Runoff curve number ..... CN = 65 (From worksheet 2)

Time of concentration ..... T_c = 0.66 hr (From worksheet 3)

Rainfall distribution ..... = III (I, IA, II III)

Pond and swamp areas sprea
throughout watershed ..... = _____ percent of A_m (_____ acres or mi² covered)

	Storm #1	Storm #2	Storm #3
2. Frequency ..... yr	2	10	25
3. Rainfall, P (24-hour) ..... in	3.5	5.25	6.0
4. Initial abstraction, I_a ..... in (Use CN with table 4-1)	1.077	1.077	1.077
5. Compute I_a/P	0.308	0.205	0.180
6. Unit peak discharge, q_u ..... csm/in (Use T_c and I_a/P with exhibit 4- III)	305	340	350
7. Runoff, Q ..... in (From worksheet 2) Figure 2-6	0.75	1.82	2.35
8. Pond and swamp adjustment factor, F_p ..... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond ans swamp area.)	1.0	1.0	1.0
9. Peak discharge, q_p ..... ft³/s	2.29	6.19	8.23
(Where $q_p = q_u A_m Q F_p$)			
36" RCP Q =	63.46	63.46	63.46
Total Q =	65.75	69.65	71.69

Worksheet 2: Runoff curve number and runoff

Project	By	Date
Navy - Earle	DMM	7/24/01
Location	**Checked**	**Date**
Site 3 - Q_2 (area EDA 2)	KSB	8/13/01

Check one: ☒ Present ☐ Developed

1. Runoff curve number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Figure 2-3	CN 1/ Figure 2-4	Area ☒ acres ☐ mi² ☐ %	Product of CN x area
Lakehurst Sand (B)	Woods - Grass Combination (Area = 211,986 ft²)	65			4.87	316.6

1/ Use only one CN source per line

Totals ➡ 4.87 | 316.6

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{316.6}{4.87} = 65$; **Use CN** ➡ 65

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr	2	10	25
Rainfall, P (24-hour)	in	3.5	5.25	6.0
Runoff, Q	in	0.75	1.82	2.35

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

Worksheet 3: Time of Concentration (T_c) or travel time (T_t)

Project	By	Date
Navy - Earle	DMM	8/3/01
Location	**Checked**	**Date**
Site 3 - Q_2 (area EDA2)	KJB	8/13/01

Check one: ☒ Present ☐ Developed

Check one: ☐ T_c ☐ T_t through subarea

Notes: Space for as many as two segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)

Segment ID	AB		
1. Surface description (table 3-1)	Dense Grass		
2. Manning's roughness coefficient, n (table 3-1)	0.25		
3. Flow length, L (total L † 300 ft) ft	299		
4. Two-year 24-hour rainfall, P_2 in	3.5		
5. Land slope, s ft/ft	0.010		
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t hr	0.74	+	= 0.74

Shallow concentrated flow

Segment ID	BC		
7. Surface description (paved or unpaved)	Unpaved		
8. Flow length, L ft	431		
9. Watercourse slope, s ft/ft	0.014		
10. Average velocity, V (figure 3-1) ft/s	1.9		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t hr	0.063	+	= 0.063

Channel flow

Segment ID			
12. Cross sectional flow area, a ft^2			
13. Wetted perimeter, p_w ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r ft			
15 Channel slope, s ft/ft			
16. Manning's roughness coefficient, n			
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V ft/s			
18. Flow length, L ft			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t hr		+	=

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) Hr 0.803

Worksheet 4: Graphical Peak Discharge method

Project	By	Date
Navy - Earle	DMM	8/3/01
Location	**Checked**	**Date**
Site 3 - Q_2 (area EDA2)	KJB	8/8/01

Check one: ☒ Present ☐ Developed

1. Data

Drainage area ..... A_m = 0.008 mi^2 (acres/640)

Runoff curve number ..... CN = 65 (From worksheet 2)

Time of concentration ..... T_c = 0.803 hr (From worksheet 3)

Rainfall distribution ..... = III (I, IA, II III)

Pond and swamp areas sprea
throughout watershed ..... = _____ percent of A_m (_____ acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3
2. Frequency	yr	2	10	25
3. Rainfall, P (24-hour)	in	3.5	5.25	6.0
4. Initial abstraction, I_a (Use CN with table 4-1)	in	1.077	1.077	1.077
5. Compute I_a/P		0.308	0.205	0.180
6. Unit peak discharge, q_u (Use T_c and I_a/P with exhibit 4– III)	csm/in	280	320	325
7. Runoff, Q (From worksheet 2) Figure 2-6	in	0.75	1.82	2.35
8. Pond and swamp adjustment factor, F_p (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond ans swamp area.)		1.0	1.0	1.0
9. Peak discharge, q_p	ft^3/s	1.68	4.66	6.11

(Where $q_p = q_u A_m Q F_p$)

Worksheet 2: Runoff curve number and runoff

Project	By	Date
Navy - Earle	DMM	8/9/01
Location	**Checked**	**Date**
Site 3 - Q, (PDA1)	KJB	8/13/01

Check one: ☐ Present ☒ Developed

1. Runoff curve number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Figure 2-3	CN 1/ Figure 2-4	Area ☒ acres ☐ mi² ☐ %	Product of CN x area
Top Soil (B)	Top of Landfill, Grass (Area = 45,086 ft²)	61			1.04	63.44
Lakehurst Sand (B)	Cleared + Grubbed, Re-Vegetated (Area = 24,546 ft²)	61			0.56	34.16
Lakehurst Sand (B)	Woods - Grass Combination (Area = 129,022 ft²)	65			2.96	192.4
					Totals ➡ 4.56	290.0

1/ Use only one CN source per line

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{290}{4.56} = 63.6 \quad ; \quad \text{Use CN} \Rightarrow \boxed{64}$$

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr	2	10	25
Rainfall, P (24-hour)	in	3.5	5.25	6.0
Runoff, Q (Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)	in	0.71	1.74	2.26

$$S = \frac{1000}{CN} - 10 = \frac{1000}{64} - 10 = 5.63$$

2 yr storm

$$Q = \frac{(P - 0.2S)^2}{P + 0.8S} = \frac{[3.5 - 0.2(5.63)]^2}{3.5 + (0.8)(5.63)} = \frac{5.64}{8.0} = 0.71$$

10 yr storm

$$Q = \frac{[5.25 - 0.2(5.63)]^2}{5.25 + (0.8)(5.63)} = \frac{17.01}{9.75} = 1.74$$

25 yr storm

$$Q = \frac{[6.0 - 0.2(5.63)]^2}{6.0 + 0.8(5.63)} = \frac{23.76}{10.50} = 2.26$$

Worksheet 3: Time of Concentration (T_c) or travel time (T_t)

Project	By	Date
NAVY - ERIE	KJB	8/14/01
Location	**Checked**	**Date**
SITE 3 - Q. (PDA 1)		

Check one: ☐ Present ☒ Developed

Check one: ☐ T_c ☐ T_t through subarea

Notes: Space for as many as two segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)

Segment ID	AB	BC	DE
1. Surface description (table 3-1)	DENSE GRASS		RIP RAP (3"⌀
2. Manning's roughness coefficient, n (table 3-1)	0.25	0.25	.032
3. Flow length, L (total L † 300 ft) ft	140	20	20
4. Two-year 24-hour rainfall, P_2 in	3.5	3.5	3.5
5. Land slope, s ft/ft	0.05	0.33	0.033
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t hr	0.21 +	0.02 =	0.24 0.005

Segment ID		
7. Surface description (paved or unpaved)		
8. Flow length, L ft		
9. Watercourse slope, s ft/ft		
10. Average velocity, V (figure 3-1) ft/s		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t hr	+	=

Channel flow

Segment ID	CD	
12. Cross sectional flow area, a ft^2	16.00	
13. Wetted perimeter, p_w ft	14.64	
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r ft	1.09	
15 Channel slope, s ft/ft	0.01	
16. Manning's roughness coefficient, n	0.25	
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V ft/s	0.63	
18. Flow length, L ft	815	
19. $T_t = \frac{L}{3600\ V}$ Compute T_t hr	0.36 +	= 0.36

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) Hr 0.60

Worksheet 4: Graphical Peak Discharge method

Project	By	Date
NAVY - EARLE	KJB	8/14/01
Location	**Checked**	**Date**
SITE 3 - Q1 (PDA 2)		

Check one: ☐ Present ☐ Developed

1. Data

Drainage area ..... A_m = 0.007 mi^2 (acres/640)

Runoff curve number ..... CN = 64 (From worksheet 2)

Time of concentration ..... T_c = 0.60 hr (From worksheet 3)

Rainfall distribution ..... = III (I, IA, II III)

Pond and swamp areas sprea throughout watershed ..... = – percent of A_m (– acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3
2. Frequency	yr	2	10	25
3. Rainfall, P (24-hour)	in	3.5	5.25	6.0
4. Initial abstraction, I_a (Use CN with table 4-1)	in	1.125	1.125	1.125
5. Compute I_a/P		0.321	0.214	0.188
6. Unit peak discharge, q_u (Use T_c and I_a/P with exhibit 4-III)	csm/in	310	350	370
7. Runoff, Q (From worksheet 2) Figure 2-6	in	0.71	1.74	2.26
8. Pond and swamp adjustment factor, F_p (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond ans swamp area.)		1.0	1.0	1.0
9. Peak discharge, q_p	ft^3/s	1.54	4.26	5.85
(Where $q_p = q_u A_m Q F_p$) + Q_{FULL} 36" RCP		63.46	63.46	63.46
+ Q_3 (PDA 3)		0.84	2.89	3.95
TOTAL		65.84	70.61	73.26

Worksheet 2: Runoff curve number and runoff

Project	By	Date
Navy – Earle	DHM	8/9/01
Location	**Checked**	**Date**
Site 3 – Q2 (PDA2)	KJB	8/13/01

Check one: ☐ Present ☒ Developed

1. Runoff curve number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Figure 2-3	CN 1/ Figure 2-4	Area ☒ acres ☐ mi² ☐ %	Product of CN x area
Top Soil (B)	Top of Landfill, Grass (Area = 56,506 ft²)	61			1.30	79.3
Lakehurst Sand (B)	Cleared + Grubbed, Re-Vegetated (Area = 23,992 ft²)	61			0.55	33.55
Lakehurst Sand (B)	Woods – Grass Combination (Area = 99,991 ft²)	65			2.30	149.5
					Totals ➡ 4.15	262.35

1/ Use only one CN source per line

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{262.35}{4.15} = 63.2$; **Use CN** ➡ 63

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr	2	10	25
Rainfall, P (24-hour)	in	3.5	5.25	6.0
Runoff, Q	in	0.66	1.67	2.18

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

Worksheet 3: Time of Concentration (T_c) or travel time (T_t)

Project	By	Date
NAVY-EARLE	KJB	8/14/01
Location	**Checked**	**Date**
SITE 3 - O_2 (PDA 2)		

Check one: ☐ Present ☐ Developed

Check one: ☐ T_c ☐ T_t through subarea

Notes: Space for as many as two segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)

Segment ID	AB	BC	DE
1. Surface description (table 3-1)	DENSE	GRASS	3" RIP RAP
2. Manning's roughness coefficient, n (table 3-1)	0.25	0.25	0.032
3. Flow length, L (total L † 300 ft) ft	25	20	55
4. Two-year 24-hour rainfall, P_2 in	3.5	3.5	3.5
5. Land slope, s ft/ft	0.05	0.33	0.20
6. $T_t = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_t hr	0.054 +	0.021 =	0.09 0.011

Segment ID		
7. Surface description (paved or unpaved)		
8. Flow length, L ft		
9. Watercourse slope, s ft/ft		
10. Average velocity, V (figure 3-1) ft/s		
11. $T_t = \frac{L}{3600\,V}$ Compute T_t hr	+	=

Channel flow

Segment ID	CD	
12. Cross sectional flow area, a ft^2	16.00	
13. Wetted perimeter, p_w ft	14.64	
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r ft	1.09	
15 Channel slope, s ft/ft	0.01	
16. Manning's roughness coefficient, n	0.25	
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V ft/s	0.63	
18. Flow length, L ft	743	
19. $T_t = \frac{L}{3600\,V}$ Compute T_t hr	0.33 +	= 0.33

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) Hr 0.42

Worksheet 4: Graphical Peak Discharge method

Project	By	Date
NAVY - EARLE	KJB	8/14/01
Location	**Checked**	**Date**
Site 3 - Q_2 (PDA 2)		

Check one: ☐ Present ☐ Developed

1. Data

Drainage area ..... A_m = 0.006 mi^2 (acres/640)

Runoff curve number ..... CN = 63 (From worksheet 2)

Time of concentration ..... T_c = 0.42 hr (From worksheet 3)

Rainfall distribution ..... = III (I, IA, II III)

Pond and swamp areas sprea throughout watershed ..... = – percent of A_m (– acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3
2. Frequency	yr	2	10	25
3. Rainfall, P (24-hour)	in	3.5	5.25	6.0
4. Initial abstraction, I_a (Use CN with table 4-1)	in	1.175	1.175	1.175
5. Compute I_a/P		0.34	0.22	0.20
6. Unit peak discharge, q_u (Use T_c and I_a/P with exhibit 4–III)	csm/in	350	400	415
7. Runoff, Q (From worksheet 2) Figure 2-6	in	0.66	1.67	2.18
8. Pond and swamp adjustment factor, F_p (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond ans swamp area.)		1.0	1.0	1.0
9. Peak discharge, q_p	ft^3/s	1.39	4.01	5.43

(Where $q_p = q_u A_m Q F_p$)

Worksheet 2: Runoff curve number and runoff

Project	By	Date
Navy - Earle	DMM	8/9/01
Location	**Checked**	**Date**
Site 3 - Q_3 (PDA3)	KJB	8/13/01

Check one: ☐ Present ☒ Developed

1. Runoff curve number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Figure 2-3	CN 1/ Figure 2-4	Area ☒ acres ☐ mi² ☐ %	Product of CN x area
Top Soil (B)	Top of Landfill, Grass (Area = 111,255 ft²)	61			2.55	155.55
Lakehurst Sand (B)	Cleared + Grubbed, Re-Vegetated (Area = 9,725 ft²)	61			0.22	13.42
Lakehurst Sand (B)	Woods - Grass Combination (Area = 12,202 ft²)	65			0.28	18.2
					Totals ➡ 3.05	187.17

1/ Use only one CN source per line

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{187.17}{3.05} = 61.4$; Use CN ➡ 61

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr	2	10	25
Rainfall, P (24-hour)	in	3.5	5.25	6.0
Runoff, Q	in	0.57	1.52	2.0

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

$$S = \frac{1000}{CN} - 10 = \frac{1000}{61} - 10 = 6.39$$

2 yr storm

$$Q = \frac{(P - 0.2S)^2}{P + 0.8S} = \frac{[3.5 - 0.2(6.39)]^2}{3.5 + 0.8(6.39)} = \frac{4.94}{8.61} = 0.57$$

10 yr storm

$$Q = \frac{[5.25 - 0.2(6.39)]^2}{5.25 + 0.8(6.39)} = \frac{15.78}{10.36} = 1.52$$

25 yr storm

$$Q = \frac{[6.0 - 0.2(6.39)]^2}{6.0 + 0.8(6.39)} = \frac{22.30}{11.11} = 2.0$$

Worksheet 3: Time of Concentration (T_c) or travel time (T_t)

Project	By	Date
NAVY - EARLE	KJR	8/14/01
Location	**Checked**	**Date**
SITE 3 - Q_3 (PDA 3)		

Check one: ☐ Present ☐ Developed

Check one: ☐ T_c ☐ T_t through subarea

Notes: Space for as many as two segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)

Segment ID	AB	CD
1. Surface description (table 3-1)	DENSE GRASS	3" RIPRAP
2. Manning's roughness coefficient, n (table 3-1)	0.23	0.032
3. Flow length, L (total L † 300 ft) ft	112	20
4. Two-year 24-hour rainfall, P_2 in	3.5	3.5
5. Land slope, s ft/ft	0.05	0.20
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t hr	0.18 +	0.011 = 0.19

Segment ID		
7. Surface description (paved or unpaved)		
8. Flow length, L ft		
9. Watercourse slope, s ft/ft		
10. Average velocity, V (figure 3-1) ft/s		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t hr	+	=

Channel flow

Segment ID	BC	
12. Cross sectional flow area, a ft^2	15.00	
13. Wetted perimeter, p_w ft	14.64	
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r ft	1.09	
15 Channel slope, s ft/ft	0.01	
16. Manning's roughness coefficient, n	0.25	
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V ft/s	0.63	
18. Flow length, L ft	749	
19. $T_t = \frac{L}{3600\ V}$ Compute T_t hr	0.33 +	= 0.33

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) Hr 0.52

Worksheet 4: Graphical Peak Discharge method

Project	By	Date
NAVY - EARLE	KJB	8/14/01
Location	**Checked**	**Date**
SITE 3 - Q_3 (PDA 3)		

Check one: ☐ Present ☐ Developed

1. Data

Drainage area ..... A_m = 0.005 mi^2 (acres/640)

Runoff curve number ..... CN = 61 (From worksheet 2)

Time of concentration ..... T_c = 0.52 hr (From worksheet 3)

Rainfall distribution ..... = III (I, IA, II III)

Pond and swamp areas sprea throughout watershed ..... = — percent of A_m (_____ acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3
2. Frequency	yr	2	10	25
3. Rainfall, P (24-hour)	in	3.5	5.25	6.0
4. Initial abstraction, I_a (Use CN with table 4-1)	in	1.279	1.279	1.279
5. Compute I_a/P		0.37	0.24	0.21
6. Unit peak discharge, q_u (Use T_c and I_a/P with exhibit 4– III)	csm/in	295	380	395
7. Runoff, Q (From worksheet 2) Figure 2-6	in	0.57	1.52	2.0
8. Pond and swamp adjustment factor, F_p (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond ans swamp area.)		1.0	1.0	1.0
9. Peak discharge, q_p	ft^3/s	0.84	2.89	3.95

(Where $q_p = q_u A_m Q F_p$)

FOSTER WHEELER ENVIRONMENTAL CORPORATION

BY KJB DATE 8/13/01 SHEET 1 OF 7

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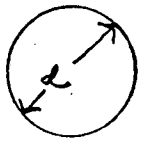
CLIENT NAVY - EARLE

PROJECT SITE 3

SUBJECT FLOW FROM 36"Φ RCP (FULL)



FIND FULL FLOW

$d = 36'' = 3'$

FIND AREA (A) $= \pi d^2/4 = \pi(3^2)/4 = 7.07\ FT^2$

FIND WETTED PERIMETER (WP) $= 2\pi r$ (FULL FLOW)
$= 2\pi(1.5) = 9.42\ FT$

FIND HYDRAULIC RADIUS (R) $= A/WP = 7.07/9.42 = 0.75\ FT$

FIND FULL FLOW (Q)

$Q = 1.49/n\ A R^{2/3} S^{1/2}$

$n = 0.013$ FOR CONCRETE PIPE

$S = \text{SLOPE} = \frac{\text{RISE}}{\text{RUN}} = \frac{117.17 - 116.49}{72} = 0.009\ FT/FT$

↳ FROM SITE PLAN INVERTS

$\therefore Q = 1.49/0.013\ (7.07)(0.75^{2/3})(0.009^{1/2})$

$= 63.46\ CFS$

FOSTER WHEELER ENVIRONMENTAL CORPORATION

BY KJB DATE 8/13/01 SHEET 2 OF 7

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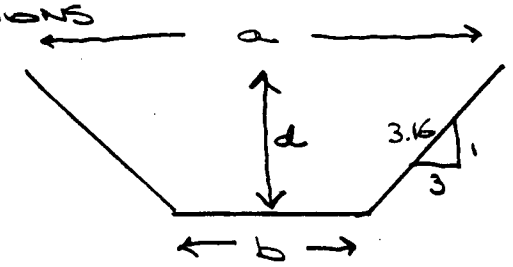
CLIENT NAVY

PROJECT EARLE

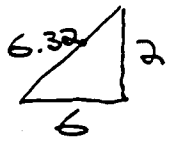
SUBJECT SITE 3 - PROPOSED SWALE CALCULATIONS

ASSUMED DIMENSIONS



$b = 2'$

$d = 2'$



FIND AREA (A)

$= \frac{1}{2}(d)(a+b)$

$= \frac{1}{2}(2)(2(3)(2)+2+2)$

$= 16 \text{ FT}^2$

FIND WETTED PERIMETER (WP)

$WP = 2(6.32) + 2$

$WP = 14.64 \text{ FT}$

FIND HYDRAULIC RADIUS (R)

$R = A/WP = 16/14.64 = 1.09$

FIND Q FOR SWALE

- SLOPE = 1% = 0.01 (DESIGN)
- $n = 0.25$ (GRASS LINED SWALE) - USDA TR-55 MANUAL

$Q = \frac{1.49}{n} A R^{2/3} S^{1/2}$

$= \frac{1.49}{0.25}(16)(1.09)^{2/3}(0.01^{1/2})$

$Q = 10.11 \text{ CFS}$

FOSTER WHEELER ENVIRONMENTAL CORPORATION

BY DMM DATE 8/8/01 SHEET 3 OF 7

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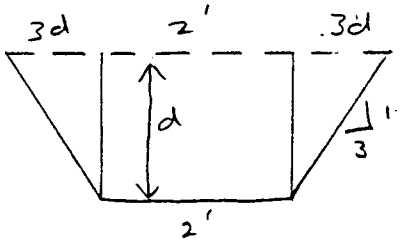
CLIENT Navy

PROJECT Earle

SUBJECT Site 3 – Proposed Swale Calculations

Find water depth (d) for Q_{25}

Use Manning's Eq.



$$Q = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

$$A = \tfrac{1}{2} d (a + b)$$
$$= \tfrac{1}{2} d [2 + (3d + 3d + 2)]$$
$$= \tfrac{1}{2} d (6d + 4)$$
$$= 3d^2 + 2d$$

$$WP = 3.16d + 2 + 3.16d = 6.32d + 2$$

$$R = \frac{A}{WP} = \frac{3d^2 + 2d}{6.32d + 2} \qquad S = 0.01 \text{ (design)}$$

Max $Q_{25} = 9.80 \text{ ft}^3/\text{s}$ (on eastern side of landfill)

$$9.80 = \frac{1.49}{0.25} (3d^2 + 2d) \left[\frac{3d^2 + 2d}{6.32d + 2} \right]^{2/3} (0.01)^{1/2}$$

$d = 1.9'$

Design $d = 2.0'$

$1.9' < 2.0'$

Design is adequate

FOSTER WHEELER ENVIRONMENTAL CORPORATION

BY DMM DATE 8/10/01 SHEET 4 OF 7

CHKD. BY FMP DATE 8/15/01 OFS NO. DEPT. NO.

CLIENT Navy

PROJECT Earle

SUBJECT Site 3 – Proposed Swale Calculations

Swale Stability

Based on the Rational Method Calculations, the maximum Q that will enter the proposed swale = 9.80 ft^3/s ($Q_1 + Q_3$)

Stability checks are not required if the actual velocity is 1.8 ft/s or less → Standards for Soil Erosion + Sediment Control (NJ) July '99

$Q = UA$

U = velocity (ft/s)
A = area of swale (ft^2)
Q = maximum flow (ft^3/s)

$$U = \frac{Q}{A} = \frac{9.80\ ft^3/s}{16\ ft^2} = 0.62\ ft/s$$

$0.62\ ft/s << 1.8\ ft/s$

Therefore, no stabilization is required. Proposed swales shall be lined with vegetative lining.

FOSTER WHEELER ENVIRONMENTAL CORPORATION

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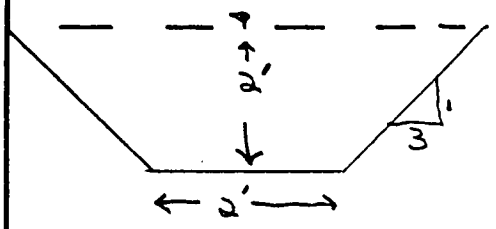
CLIENT NAVY EARLE

PROJECT SITE 3

SUBJECT CONDUIT OUTLET PROTECTION - PDA 1 (Q_1)



- USING STANDARD 12-1 OF THE STANDARDS FOR SOIL EROSION AND SEDIMENT CONTROL

FIND LENGTH OF APRON (L_a) REQUIRED

$L_a = (1.8\, q/D_o^{1/2}) + 7D_o$

$D_o = 2'$

$W_o = 14$

$q = \frac{Q_{25}}{W_o} = \frac{9.80}{14} = 0.72$

- FOR Q_1
- TOTAL Q EQUALS SUM OF 25 YR Q FROM AREAS PDA-1 AND PDA-3

∴ FROM TR-55 CALCS $Q_{25_{TOT}} = Q_{1_{25}} + Q_{3_{25}} = 5.85 + 3.95$
$= 9.80$ CFS

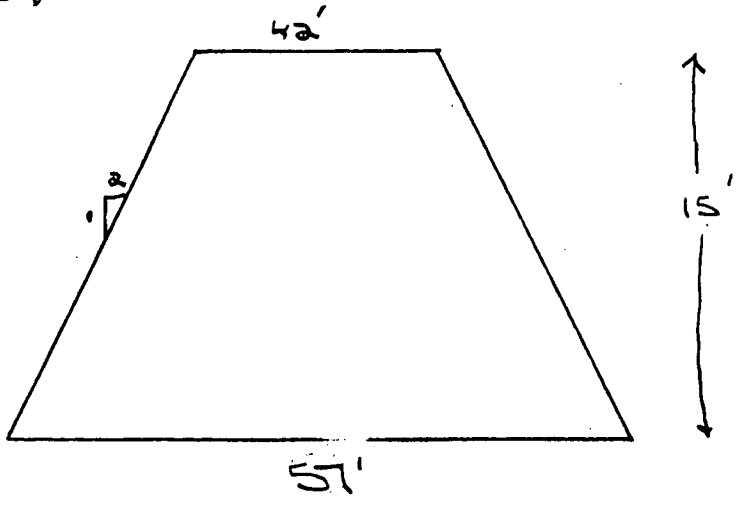
$L_a = 1.8\left(\frac{0.72}{2^{1/2}}\right) + 7(2)$

$L_a = 14.89$ FT ≈ FT

$1 \leftarrow 3W_o \rightarrow 1$

FIND WIDTH OF APRON (W)

$W = 3W_o + L_a$
$= 3(14) + 15$
$= 57$ FT



FOSTER WHEELER ENVIRONMENTAL CORPORATION

BY KJB DATE 8/14/01 SHEET 6 OF 7

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CLIENT NAVY - FARVE

PROJECT SITE 3

SUBJECT CONDUIT OUTLET PROTECTION - PDA1 (Q1)

FIND MEDIAN STONE DIAMETER - D_{50}

$$D_{50} = \frac{0.016}{0.2D_0} Q^{1.33} = \frac{0.016}{0.2(2)} (0.72)^{1.33} = 0.25' = 3''\phi$$

$\therefore D_{50} = 3''$

FIND THICKNESS OF RIP-RAP

- THICKNESS = $2D_{50}$ DUE TO THE USAGE OF FILTER FABRIC

$\therefore$ THICKNESS = $2(3) = 6''$

FOSTER WHEELER ENVIRONMENTAL CORPORATION

BY KJB DATE 8/14/01 SHEET 7 OF 7

CHKD. BY FMP DATE 8/15/01 OFS NO. DEPT. NO.

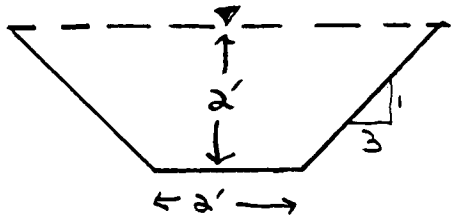
CLIENT NAVY - EARLE

PROJECT SITE 3

SUBJECT CONDUIT OUTLET PROTECTION - PDA2 (Q_2)

- FROM TR-55 CALCULATION FOR AREA PDA2 (Q_2), FLOW (Q_{25}) FOR 25 YR STORM:

$Q_{25} = 5.43$ CFS



- USING STANDARD 12-1 (CONDUIT OUTLET PROTECTION)

L_a = LENGTH OF APRON

$= 1.8\left(\frac{q}{D_o^{1/2}}\right) + 7D_o$

$D_o = 2'$

$W_o = 14'$

$q = \frac{Q_{25}}{W_o} = \frac{5.43}{14} = 0.40$

$\therefore 1.8\left(\frac{0.40}{2^{1/2}}\right) + 7(2)$

$= 14.51' \approx 15' = L_a$

WIDTH OF APRON $(W) = 3W_o + L_a$

$= 3(14) + 15$

$= 57'$

MEDIAN STONE DIAMETER $(D_{50}) = \frac{0.016}{0.2D_o} q^{1.33} = \frac{0.016}{0.2(2)}(0.40)^{1.33}$

$D_{50} = 0.12' = 1.5''$ $\therefore$ USE 3"ϕ

THICKNESS OF RIP RAP APRON

- WITH USE OF FILTER FABRIC → THICKNESS $= 2D_{50}$

$= 2(1.5)$

$= 3''$

- HOWEVER, STANDARD CALLS FOR MIN. 6" $\therefore$ THICKNESS = 6"