# Stormwater Pollution Prevention Plan
# Bill Sanderson Gas Plant
# Williams County, North Dakota

**MARCH 2020**

PREPARED FOR

**OE2 North LLC**

PREPARED BY

**SWCA Environmental Consultants**

# STORMWATER POLLUTION PREVENTION PLAN
# BILL SANDERSON GAS PLANT
# WILLIAMS COUNTY, NORTH DAKOTA

Prepared for

**OE2 North LLC**
1200 17th Street, Suite 900
Denver, Colorado 80202

Prepared by

**SWCA Environmental Consultants**
116 North 4th Street, Suite 200
Bismarck, North Dakota 58501

March 2020

# CONTENTS

## Appendices



## Figures



## Tables

*This page intentionally left blank.*

# 1 STORMWATER POLLUTION PREVENTION PLAN ADMINISTRATION

## 1.1 Regulatory Overview

The U.S. Environmental Protection Agency controls stormwater and sewer overflow discharges through its National Pollutant Discharge Elimination System (NPDES) program and provides guidance to municipalities, and state and federal permitting authorities on how to meet stormwater pollution control goals as flexibly and cost-effectively as possible. Responsibility for implementation of these regulations has been delegated to the North Dakota Department of Environmental Quality (NDDEQ), Division of Water Quality through the North Dakota Pollutant Discharge Elimination System (NDPDES). NDPDES general permit NDR100000 (NDDEQ 2020)applies to stormwater discharges associated with large construction activity and small construction activity, as defined in Title 40 of the Code of Federal Regulations (CFR), Parts 122.26(b)(14)(x) and (b)(15), respectively, and summarized below.

- Large construction activity includes clearing, grading, and excavation that disturbs a land area equal to or greater than 5 acres and includes the disturbance of less than 5 acres that is part of a larger common plan of development or sale, if the larger common plan will ultimately disturb 5 acres or more.
- Small construction activity includes clearing, grading, and excavation that disturbs a land area equal to or greater than 1 acre and includes the disturbance of less than 1 acre that is part of a larger common plan of development or sale, if the larger common plan will ultimately disturb a total area equal to or greater than 1 acre and less than 5 acres.
- Discharges of stormwater from oil and gas exploration, production, processing, or treatment operations, or transmission facilities composed of contaminated runoff by contact with or that has come into contact with, any overburden, raw material, intermediate products, finished product, byproduct, or waste products located on the site of such operations.

Stormwater discharges from support activities (e.g., concrete or asphalt batch plants, equipment staging yards, material storage areas, excavated material disposal areas, borrow areas) may be covered by NDR100000 as part of a related construction site. Similar facilities that will serve multiple projects or are commercial in nature must be covered by a different permit. In many cases, it will be appropriate for construction support facilities to be covered under general permit NDR320000, stormwater discharges from mining, extraction, or paving material preparation activities.

NDDEQ regulations require submittal of a complete application (Notice of Intent [NOI]) and development of a Stormwater Pollution Prevention Plan (SWPPP). Permit coverage becomes effective automatically 7 days after submittal of the NOI unless otherwise notified by the NDDEQ.

Construction activities potentially produce many kinds of pollutants that may adversely impact stormwater. The goal of a SWPPP and the use of best management practices (BMPs) is to improve water quality by reducing pollutants in stormwater discharges. The main pollutant of concern with construction projects is sediment, which can become entrained in stormwater runoff after excavation and/or grading activities that remove the protective vegetative cover. When the stormwater runoff carrying these sediments reaches a lake or stream and slows down, the suspended sediments are deposited, and can choke the stream channel or cover areas where fish spawn and aquatic plants grow. The sediment can cloud surface waters and cause aquatic respiration problems, potentially resulting in the death of fish and plants in these systems. Further, sediment-laden stormwater runoff can adversely impact downgradient

land resources and wildlife habitats. Construction activities may also involve the use of toxic or hazardous materials, such as petroleum products (fuels, lubricants, solvents), fertilizers, pesticides, herbicides, building materials (asphalt, sealants, concrete), and other chemicals, that can be harmful to humans and aquatic life, and these materials can be transported in stormwater runoff.

OE2 North LLC (OE2) prepared this SWPPP for implementation during construction of the Bill Sanderson Gas Plant in Williams County, North Dakota (Figure 1) to: 1) satisfy the NDPDES permit requirements for large and small construction activities as defined in Title 40 CFR Parts 122.26(b)(14)(x) and (b)(15), respectively; 2) provide guidance for a minimum standard of care for the use of erosion- and sediment-control BMPs where permit coverage is not required; and 3) to satisfy the NDR100000 general permit conditions and SWPPP requirements. The NOI was submitted on February 28, 2020, to the NDDEQ to obtain regulatory permit coverage for stormwater discharges associated with construction activity. Copies of the NOI and the stormwater construction permit coverage letter are provided in Appendix A. Copies of the SWPPP will be maintained at OE2's Denver, Colorado, offices and at the construction trailer at the site.

## 1.2 Owner/Operator Information

OE2 North LLC
1200 17th Street, Suite 900
Denver, Colorado 80202
Telephone: 720-638-7312

## 1.3 SWPPP Administration

Grant Burchell
Senior Vice President, Engineering and Operations
OE2 North LLC
1200 17th Street, Suite 900
Denver, Colorado 80202
Office: 720-638-7312

Andrew Perdue
Senior Project Engineer
OE2 North LLC
1200 17th Street, Suite 900
Denver, Colorado 80202
Office: 720-361-2580
Cell: 720-244-0456

Jim Dawson
Senior Environmental Specialist
SWCA Environmental Consultants
116 North 4th Street, Suite 200
Bismarck, North Dakota 58502
Office: 701-258-6622
Cell: 701-595-2081

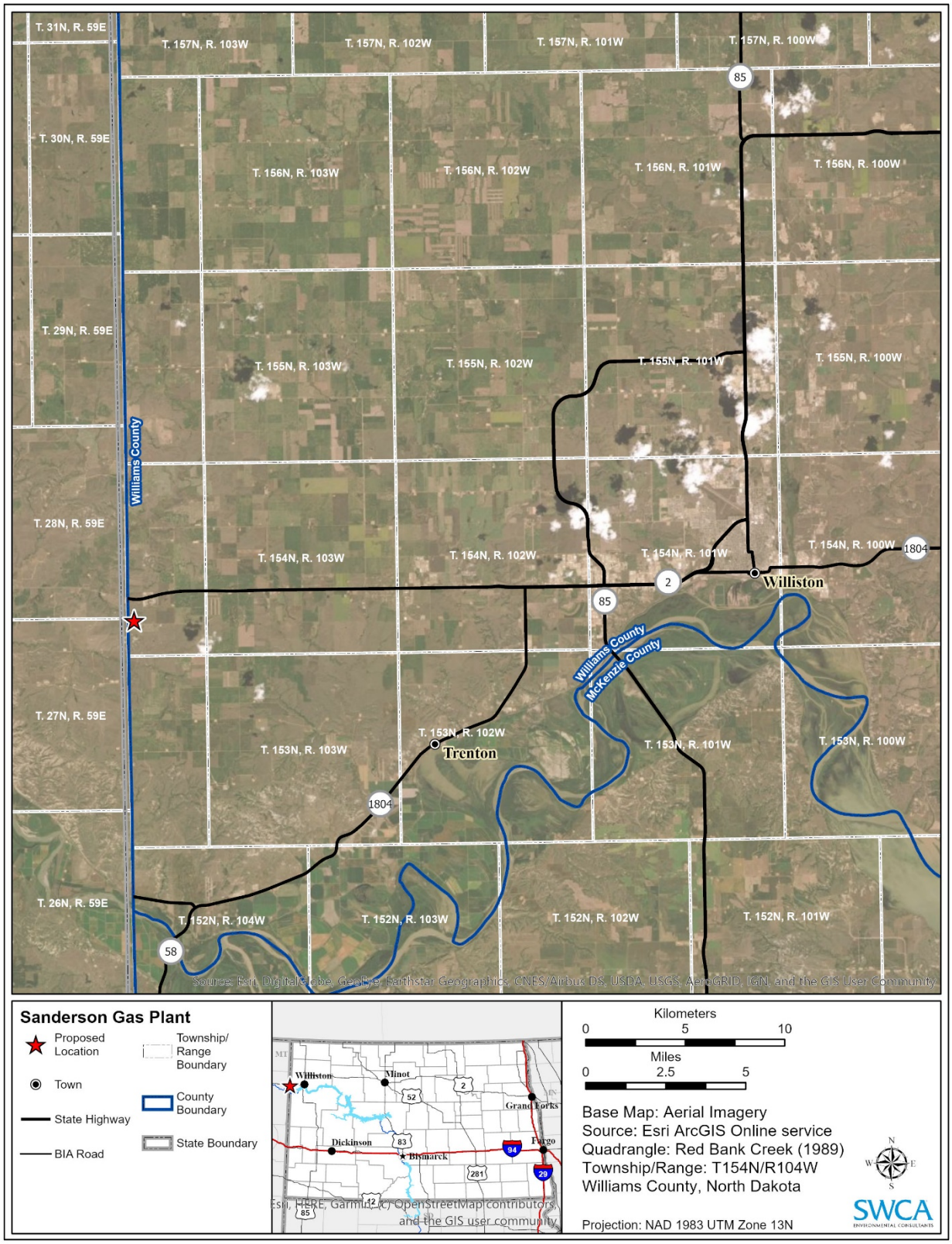



**Figure 1. Site location map.**

# 1.4 SWPPP Implementation Team

The persons listed in the Table 1 will ensure that the SWPPP is effectively implemented and that appropriate BMPs are installed correctly, inspected regularly, and maintained until the construction site has achieved final stabilization.

**Table 1. SWPPP Team**

| Name | Telephone Number |
|---|---|
| Grant Burchell | (720) 638-7312 |
| Andrew Perdue | (720) 361-2580 |
| Jim Dawson | (701) 258-6622 |
| Additional SWPPP Inspectors | TBD |

## *1.4.1 SWPPP Team Administrator*

The SWPPP Team Administrator will be Grant Burchell, Senior Vice President, Engineering and Operations, or his designee. The Team Administrator is responsible for the following actions.

- Dedicating the necessary financial and human resources to implement the SWPPP.
- Implementing spill response clean ups.
- Assigning responsibilities and working with the SWPPP Team Coordinator.
- Notifying local authorities and residents or landowners and the appropriate agencies in the event that a significant release of impacted stormwater leaves the site.
- Signatory authority.

The Team Administrator will either designate a Team Coordinator or assume some or all the duties listed in Section 1.4.2.

## *1.4.2 SWPPP Team Coordinator*

The SWPPP Team Coordinator is responsible for the following.

- Notifying the SWPPP Administrator of any spills.
- Coordinating various stages of SWPPP development and implementation.
- Coordinating employee training and conducting inspections.
- Implementing and improving housekeeping measures.
- Coordinating implementing the preventive maintenance program.
- Maintaining all records.

# 1.5 Spill Notification Contact Information

Spill notification contact information for outside parties, public safety officials, and government agencies is summarized in Table 2. Spill prevention, response, and notification procedures are discussed in Section 4.8.

**Table 2. Notification of Outside Parties, Public Safety Officials, and Government Agencies for the Bill Sanderson Gas Plant Project**

| | |
|---|---|
| **PUBLIC SAFETY NOTIFICATION** | |
| **Fire** | 911 |
| **Police** | 911 |
| **GOVERNMENT AGENCY NOTIFICATIONS – VERBAL** | |
| **National Response Center** | 1-800-424-8802<br>24 hours/day, 7 days/week |
| **North Dakota Department of Environmental Quality** | |
| 24-hour Environmental Emergency Spill Reporting Line – from inside North Dakota | 1-800-472-2121 |
| Environmental Health Section – normal business hours | 701-328-5210 or<br>701-328-5166 |
| Online Spill Reporting Website | https://deq.nd.gov/eir/NonOilfield/ |
| **North Dakota Industrial Commission** | |
| Oil and Gas Division – normal business hours | 701-328-8020 |
| Online Spill Reporting Website | https://www.dmr.nd.gov/oilgas/mvc/wincident/ |
| **North Dakota Emergency Management** | 24-Hour Hotline: 1-800-472-2121 |
| **Williams County** | |
| Emergency Management (Mike Smith, Director) | 701-577-7707 |
| Williams County Sheriff's Department (Verlan Kvande, Sheriff) | 701-577-7707 |
| **GOVERNMENT AGENCY NOTIFICATIONS – WRITTEN** | |
| **Reporting spills that have the potential to reach, or have reached, state waters** | |
| North Dakota Department of Environmental Quality<br>918 East Divide Avenue<br>Bismarck, North Dakota 58501 | 701-328-5210 or<br>701-328-5166 |
| National Response Center<br>c/o United States Coast Guard (G-OPF) Room 2611<br>2100 2nd Street SW<br>Washington, DC 20593-0001 | 1-800-424-8802 (24-hour) or 202-267-2675 |
| North Dakota Industrial Commission<br>Department of Mineral Resources, Oil and Gas Division<br>600 East Boulevard Avenue, Department 405<br>Bismarck, North Dakota 80505 | 701-328-8020 |
| Environmental Protection Agency - Region 8<br>999 18th Street, Suite 300<br>Denver, Colorado 80202-2466 | 1-800-227-8917<br>303-312-6312 |

## 1.6 Permit Compliance

OE2 will comply with the general permit conditions and provisions of this SWPPP until a Notice of Termination (NOT) has been submitted to the NDDEQ. The NOT will be submitted when one of the following conditions has been met.

- Final stabilization, as specified in Part II(E) of the general permit and discussed in Section 4.6, has been achieved on all portions of the project.
- Another owner, operator, or permittee has assumed control, in accordance with the transfer provisions of Part I(F) of the general permit, over all areas of the project that have not achieved final stabilization.

# 2 PROJECT OVERVIEW

## 2.1 Project Description

OE2 will construct the Bill Sanderson Gas Plant in the SW¼SE¼ and SE¼SE¼ of Section 27, Township 154 North, Range 104 West, Fifth Principal Meridian, Williams County, North Dakota (see Figure 1). The plant will be a 250-million standard cubic feet per day (MMscfd) cryogenic natural gas processing facility that will produce natural gas liquids (NGLs) and pipeline-quality natural gas. The plant will have the capability of producing 60,000 barrels per day of NGLs and 200 MMscfd of pipeline-quality natural gas. All incoming natural gas and outgoing NGLs and processed natural gas will be transported by pipeline. Process wastewater and slop oil will be stored in aboveground storage tanks and removed by tanker truck for transport to a state-approved oilfield treatment and disposal facility. The general layout of the plant is illustrated in Figure 2; engineering drawings, equipment descriptions, the grading plan, and construction details are presented in Appendix B.

This SWPPP covers the activities associated with construction of the Bill Sanderson Gas Plant as well as any off-site temporary workspaces required for construction equipment staging, pipeline or equipment fabrication, and materials storage (e.g., pipe yards, soil stockpiles, borrow areas) that are part of the proposed project.

Construction activities associated with this project include, but are not limited to, clearing and grubbing; topsoil removal and segregation; trenching, backfilling, and compaction; pipe placement and welding (i.e., chemical and/or electric arc); establishing temporary workspaces; and site grading. Upon completion of gas plant construction, disturbed land areas outside of the plant perimeter road, the electrical substation, and the stormwater detention pond will be seeded to re-establish vegetative cover to meet the requirements of the permit.

## 2.2 Project Area

### *2.2.1 Land Disturbance Area*

The plant site and electrical substation area inside the perimeter fence is approximately 38.63 acres. The total land disturbance area for the project includes approximately 14.9 acres for the plant site, 8.9 acres for the stormwater detention pond and conveyances, 5.3 acres for improvements to 49th Street NW, and 3.6 acres for the electrical substation, for a total of 32.7 acres.

### *2.2.2 Climate*

Annual precipitation in western North Dakota averages 15 to 17 inches. Most of the precipitation originates as frontal storms, with some of it deposited as snow, or from thunderstorms. The prevailing winds in western North Dakota are generally from the northwest.

From May through September, precipitation comes primarily from thunderstorms, with the preponderance of storms occurring from June through August. Thunderstorms occasionally produce intense showers that can deposit 1.5 inches or more of rain within a few hours. Flash floods sometimes occur in streambeds that are normally dry.

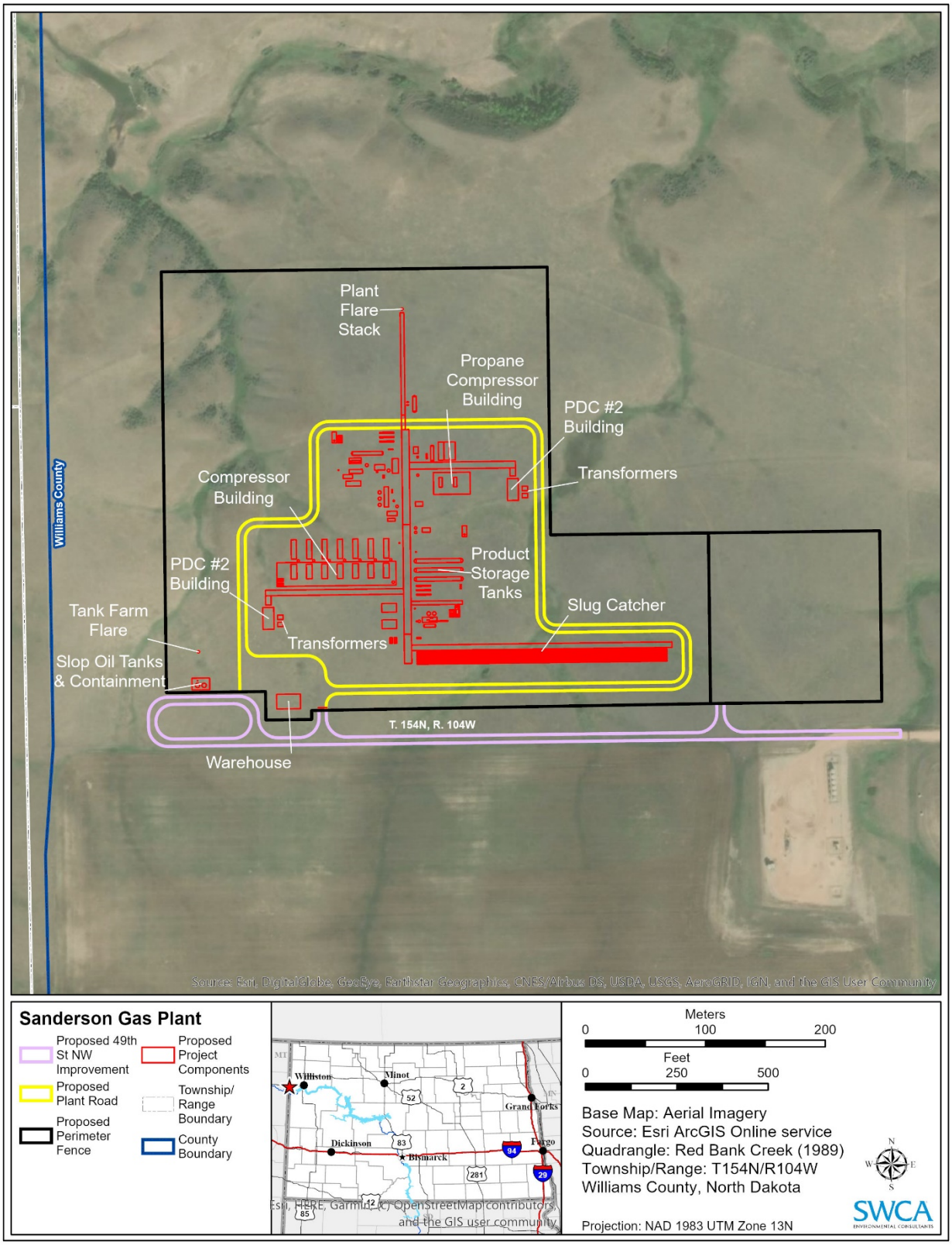



**Figure 2. Bill Sanderson Gas Plant layout.**

The intensity and amount of precipitation in North Dakota varies by location geography. The Permit requires that BMPs be designed and implemented to function properly and minimize sediment-laden stormwater discharges for the 2-year, 24-hour storm event, which amounts to about 1.9 inches in Williams County. Precipitation amounts for different frequency storm events are listed below.

- 2-year, 24-hour event: 1.9 inches
- 2-year, 10-day event: 3.2 inches
- 25-year, 24-hour event 3.6 inches
- 100-year, 24-hour event: 4.5 inches
- 25-year, 10-day event: 6.0 inches

### *2.2.3 Soils*

Based on data from the Natural Resources Conservation Service (NRCS) Web Soil Survey (NRCS 2020), four soil associations are present within the vicinity of the plant site (Figure 3; Table 3). Within the plant site perimeter fence, these soil associations include 1) Vida-Zahill loam, 2 to 8 percent slopes, described as well-drained, deep (55–79 inches) clay loams and loams developed on fine loamy till, with a depth to the water table greater than 80 inches; 2) Zahill loam, 15 to 60 percent slopes, described as a well-drained, deep (51–79 inches) loam developed on fine loamy till, with a depth to the water table greater than 80 inches; 3) Williams-Bowbells loams, 3 to 6 percent slopes, described as well-drained, moderately deep (36–60 inches) clay loams developed on fine loamy till, with a depth to the water table greater than 80 inches; and 4) Zahill-Vida loams, 4 to 15 percent slopes, described as well-drained, deep (51–79 inches) loams and clay loams developed on loamy till, with a depth to the water table greater than 80 inches. All of these soils are classified as Hydrologic Group C soils, which have a moderate runoff potential.

**Table 3. Soils within the Plant Perimeter Fence**

| MUSYM | Description | Area | |
|---|---|---|---|
| | | Acres | Percent |
| 2015 | Williams-Bowbells loams, 3 to 6 percent slopes | 6.59 | 17.0 |
| 2032 | Vida-Zahill loams, 2 to 8 percent slopes | 20.19 | 52.3 |
| 2081 | Zahill-Vida loams, 4 to 15 percent slopes | 0.29 | 0.8 |
| 2176 | Zahill loam, 15 to 60 percent | 11.56 | 29.9 |
| **Total** | | **38.63** | **100.0** |

MUSYM = map unit symbol

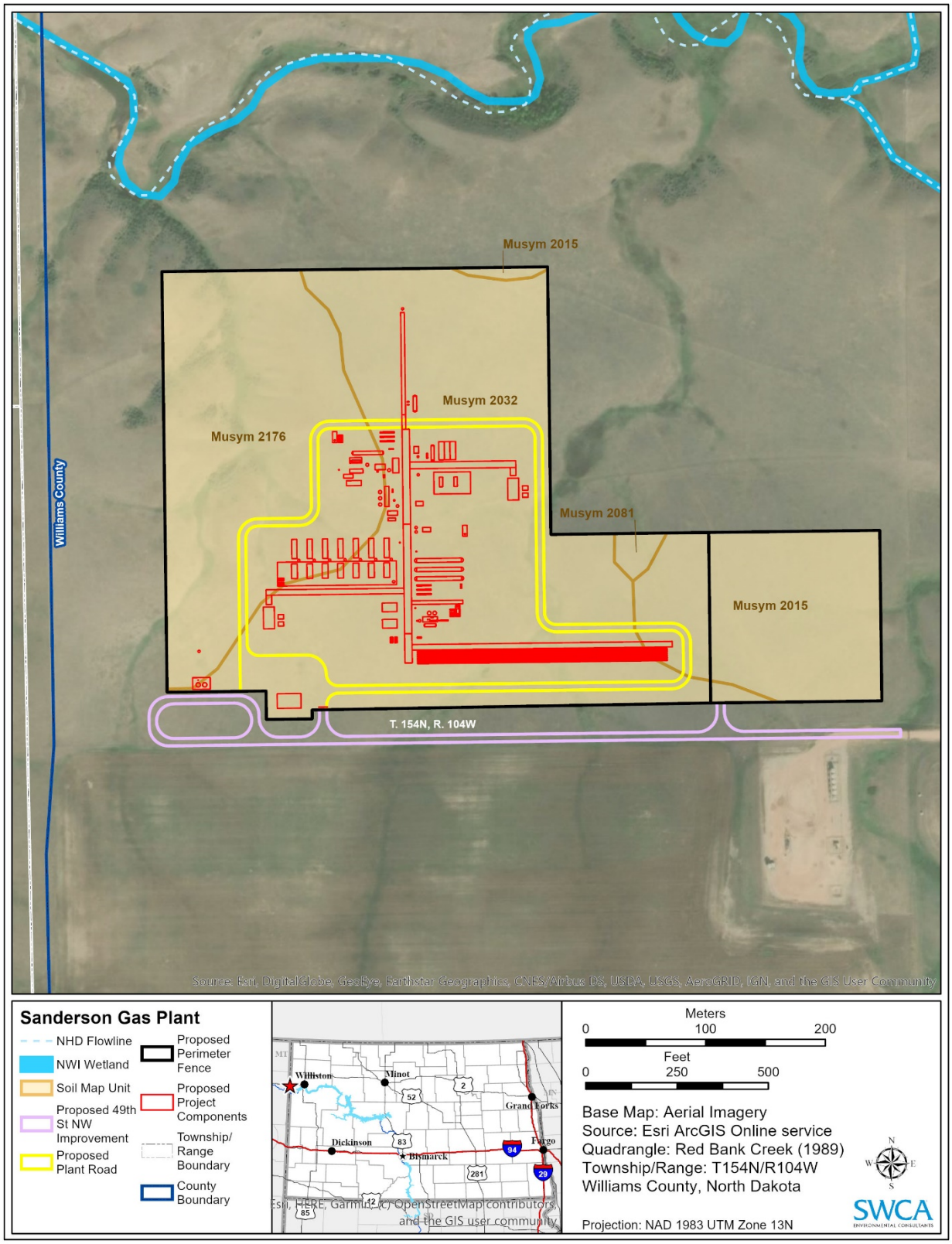



**Figure 3. Soils map.**

### 2.2.4 Geology

As described by Freers (1970), the surficial geology consists primarily of Pleistocene-age glacial till of the Cole Harbor formation and is characterized as olive-gray to tan pebbly deposits of clay, silt, sand, and gravel up to 100 feet in thickness. The till may contain lignite and clinker pebbles, while cobble- and boulder-size erratics may be composed of granite, gneiss, banded iron, basalt, limestone, and dolostone. The bedrock geology consists of the Paleocene-age Sentinel Butte formation which is characterized as grayish brown deposits of silt, sand, clay, sandstone, and lignite (Freers 1970).

## 2.3 Construction Narrative and Timeframe

Stormwater management has two primary objectives: 1) to prevent or minimize surface water from flowing onto the site (i.e., run-on) so that the site is maintained in good condition and is accessible for site operations; and 2) to control stormwater runoff so that any deleterious effects (e.g., erosion and sedimentation) from this runoff on the downgradient land and water resources are prevented or minimized. An integral aspect of these two objectives is to prevent precipitation and surface water run-on/run-off on the site from coming into contact with toxic or hazardous materials.

As described in the following sections and summarized in Table 4, the project will be developed in three phases. The BMPs to be implemented in each phase are identified in the following sections, while more specific BMP information is provided in Section 4.0. BMP location maps are presented in Appendix C, and BMP details and construction specifications are included in Appendix D.

### 2.3.1 Phase 01 – Pre-Construction Activities

Pre-construction activities will include the project kick-off meeting, contractor and employee SWPPP training, and installation of the selected temporary pre-disturbance BMPs in the project area. Such temporary controls may include silt fences and/or straw wattles at the locations identified on the BMP location maps presented in Appendix C. In conjunction with the silt fences/straw wattles, existing vegetation bordering the project site will be preserved (i.e., a permanent BMP) to the extent possible to help retard stormwater run-on and runoff, and to provide a vegetative buffer on the downhill sides of the project site.

### 2.3.2 Phase 02 – Active Construction

Active construction will entail concurrent and sequential activities, including clearing; topsoil removal/stockpiling; excavation; equipment/building construction, fabrication, and installation; hydrostatic testing; and plant start-up and troubleshooting. Detailed topography of the plant site is presented in Appendix B and shown on the BMP location maps in Appendix C.

### 2.3.3 Phase 03 – Post-Construction Inspection and Maintenance

During the post-construction final stabilization period, temporary and permanent stormwater BMPs will be regularly inspected and maintained, as required, to ensure that they are functioning properly. Once final stabilization has been achieved as specified in the permit conditions, any temporary BMPs will be removed and a Notice of Termination (NOT) will be submitted to the NDDEQ to terminate the permit.

**Table 4. Bill Sanderson Gas Plant Construction Timeframe**

| Description | Duration (days) | Cumulative Total (days) |
|---|---|---|
| **Phase 01 – Pre-Construction** | | |
| Project kick-off meeting/SWPPP training | 0.5 | 0.5 |
| Install pre-construction stormwater BMPs† | 1.5 | 3.0 |
| **Phase 02 – Active Construction** | | |
| Clearing, grubbing, and topsoil removal/stockpiling | 7 | 10 |
| Cut and fill operations; stormwater detention pond construction; final grading, ditch construction, riprap placement, plant pad construction, 49th Street improvements, topsoil spreading, seeding, stabilization | 50 | 60 |
| Gas plant construction (shop fabrication, building foundations, electrical and equipment installation and construction, hydrostatic testing, etc.) | 213 | 273 |
| Plant startup/troubleshooting | 13 | 286 |
| BMP inspections, installation, and maintenance | 22 | N/A |
| **Phase 03 – Post-Construction** | | |
| Final stabilization period | 180 | 466 |
| BMP inspection and maintenance | 12 | N/A |
| Final inspection and remove temporary BMPs | 2 | 468 |
| File NOT | 1 | 469 |

Notes:

- Duration and total are expressed as calendar days.
- BMP installation and construction activities will be staged in a manner that will minimize the time between initial disturbance and the start of reclamation.
- BMP inspection, installation, and maintenance is a concurrent activity throughout the active construction and post-construction phases of the project and thus, the estimated duration of this activity is not included in the total project timeline. The estimated duration of this activity is based on the anticipated inspection schedule during active construction (every 14 days) and post-construction (every 30 days) phases, assumed precipitation-required inspections (active construction = 6 days; post-construction = 0 days), and required in-field BMP installation/maintenance activities (active construction = 6 days; post-construction = 6 days).
- Once final stabilization has been achieved, temporary BMPs (e.g., silt fence) will be removed and disposed of at an approved disposal facility, and the NOT will be submitted to the NDDEQ.

## 2.4 Nearby Surface Water Discharges

As shown in Figure 3, the nearest surface waterbody is an unnamed intermittent tributary to Little Muddy Creek that is slightly more than 900 feet due north of the plant site. Pre-construction drainage from the plant site occurs in northeastern and northwestern drainageways. A stormwater detention pond has been designed to capture sediment and regulate discharge volumes (see Appendix B). Site grading will direct the majority of the runoff from the plant site to the northwestern drainageway where the stormwater detention pond will be constructed. Stormwater runoff from the agricultural lands to the south of 49th Street will be diverted to the east and west and will not run onto the site.

### *2.4.1 Location of Stormwater Outfalls*

Pre-construction topography of the site and surface water runoff directions are illustrated in Figure 4, which indicates that the general direction of surface water runoff is to the northwest and northeast. Stormwater outfalls and initial BMP locations are illustrated in Figure 5, and outfall locations are summarized in Table 5.

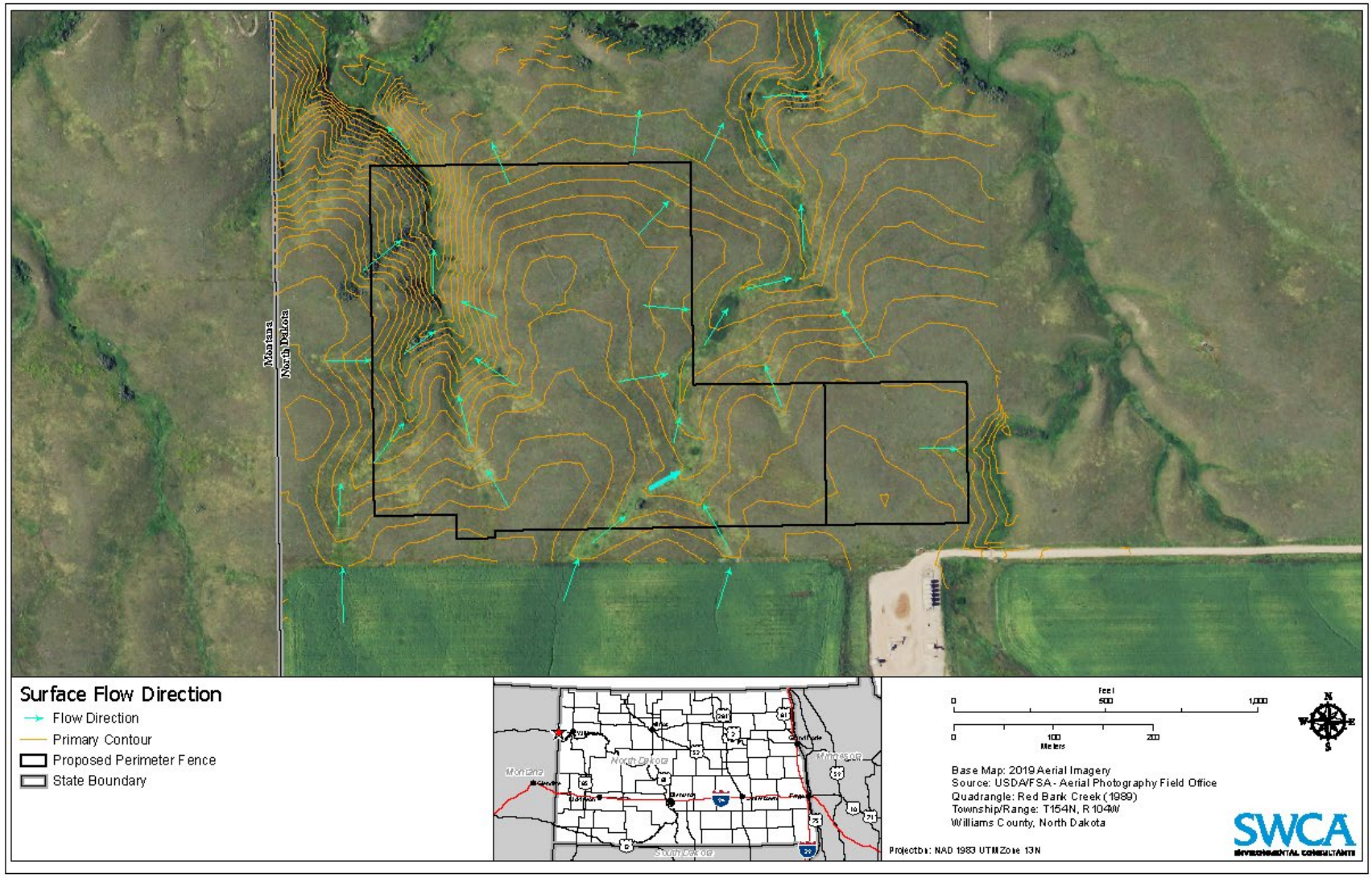



**Figure 4. Pre-construction surface topography and water flow paths.**

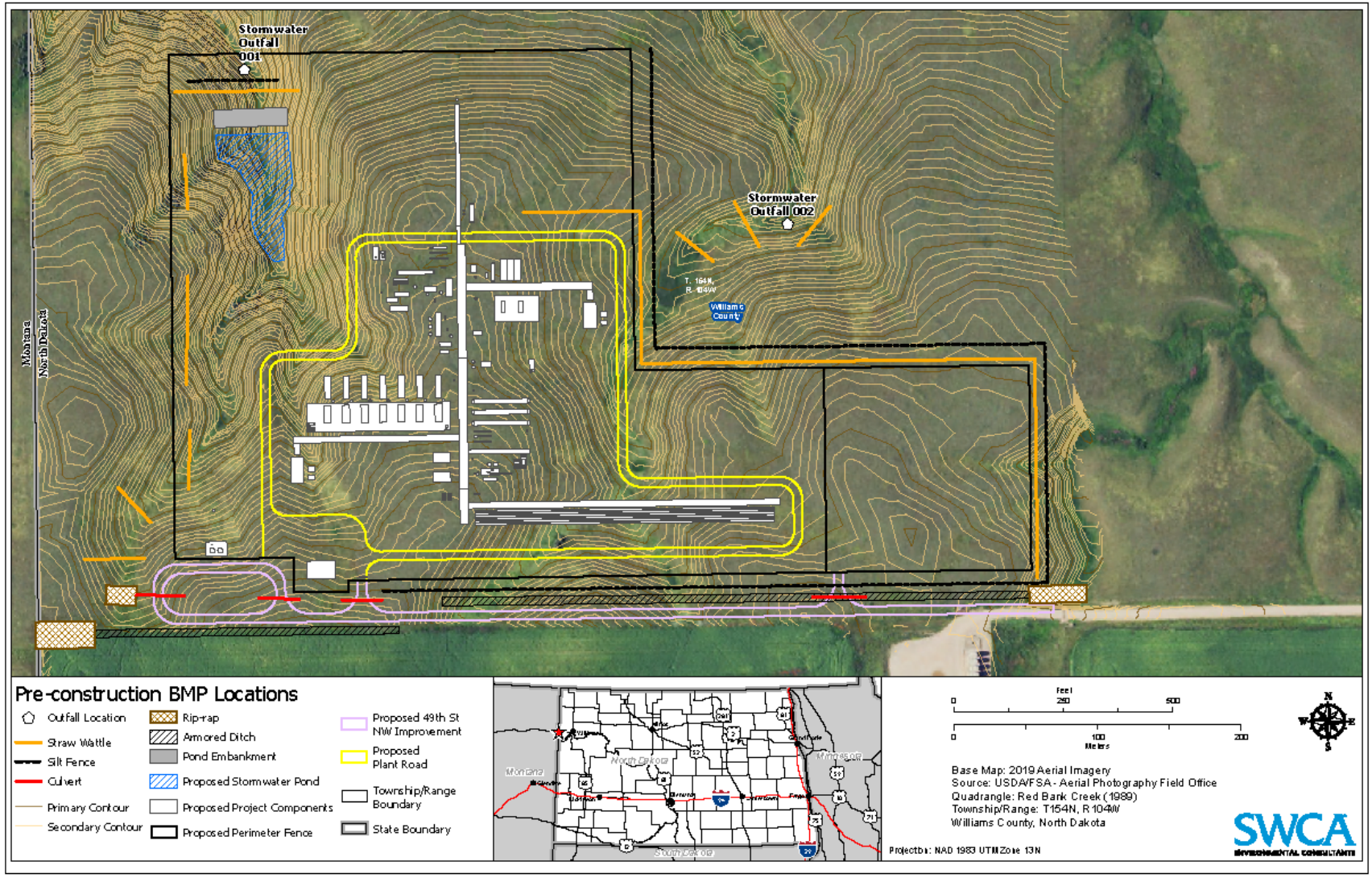



**Figure 5. Initial BMP locations.**

**Table 5. Stormwater Outfall Location Information**

| Outfall | Location | | Receiving Stream |
|---|---|---|---|
| | Latitude | Longitude | |
| 001 | 48.129277° | -104.043211° | Unnamed intermittent tributary to Little Muddy Creek |
| 002 | 48.128250° | -104.038249º | |

### *2.4.2 Drainage Controls Within the Outfalls*

During facility construction, engineering controls and work practices will be used to prevent potential stormwater impacts resulting from erosion of excavated materials or chemical impacts due to stormwater coming into contact with construction materials, fuel products, or equipment and being transported off site. Diversionary dikes or swales may be necessary to prevent or control stormwater running onto disturbed areas of the site.

Stormwater runoff may leave the site construction area via small drainage channels to the northeast and northwest to the stormwater detention pond. In cleared areas or on slopes, stormwater may form rills or gullies before flowing into a nearby tributary draw or drainageway. Structural controls will be placed at the outfalls to prevent erosion and reduce the amount of sediment that is entrained in the stormwater runoff.

## 2.5 Nearby Section 303(D) Impaired Waterbodies

No total maximum daily load (TMDL) surface waterbodies are within 2,000 feet of the project site. Waterbodies within this area have been reviewed to determine if they are listed as TMDL-listed streams and lakes, as presented in the *North Dakota 2018 Integrated Section 305(b) Water Quality Assessment Report and Section 303(d) List of Waters Needing Total Maximum Daily Loads* (North Dakota Department of Health 2018).

This SWPPP primarily addresses pollutants derived from land-disturbing activities; however, it also addresses those pollutants associated with construction materials, equipment, and operations (e.g., steel, plastic, thermal and chemical welding products, concrete, trash, debris, petroleum products, and solvents and other chemicals). See Section 3.3 for a summary of potential pollutant sources associated with facility and pipeline construction activities.

## 2.6 Construction Dewatering

Uncontaminated stormwater, surface water, and groundwater that collects on the project site in excavations or diked areas or the stormwater detention pond may be discharged under the general permit. Adequate control measures (e.g., filter bags, discharge containment structures, etc.) will be used for these discharges to minimize soil erosion and sedimentation at the discharge location.

While not anticipated, there is a potential for dewatering during site construction and/or discharges from onsite operations, such as hydrostatic testing. If the need for these discharges becomes apparent, OE2 will submit an application (NOI, Short Form C, SFN 8319) for a general permit (NDG070000) for discharges associated with hydrostatic testing and dewatering. The NOI will be submitted a minimum of 30 days prior to the anticipated discharge date. Water generated from these activities will be directed to a sediment pond, settlement trap, filter bag, or other control device to remove sediment and minimize downgradient erosion.

Dewatering activities will be inspected daily to ensure that the BMPs at the discharge location are being implemented correctly and that they are functioning as intended to prevent discharges of pollutants to state waters. The dewatering inspection report will contain the following information.

- Date and time of the inspection.
- Inspector name.
- Approximate volume of water discharged.
- Findings of the inspection, including recommendations and schedule for corrective actions.
- Corrective actions taken (including dates, times, and party completing maintenance activities).
- Documentation that the SWPPP has been amended when changes are made to the dewatering activity in response to inspections.

# 3 POTENTIAL POLLUTION SOURCES AND MATERIAL INVENTORY

## 3.1 Structural Controls to Reduce Stormwater Pollution

Potential pollution sources and associated BMP selection guidelines to address the potential pollution sources during the different phases of site construction are summarized in Table 6. Each of the structural control measures for these BMPs is discussed in Section 4.0, and BMP details and construction specifications are presented in Appendix D.

Structural control measures will be used to protect slopes and dissipate erosive energy along cut/fill slopes, shoulders of the plant access road and 49th Street, and at stormwater outfalls as shown on the BMP location maps (see Figure 5 and Appendix C). Stormwater diversion structures and/or secondary containment structures (e.g., straw wattles) will be placed around soil stockpiles to prevent eroded sediments from becoming entrained in stormwater runoff from these areas. Excavated topsoil, ground cover, and overburden will be stored in locations away from natural drainages.

## 3.2 Materials Handling, Loading, and Storage Areas

### *3.2.1 Materials Handling, Loading, and Storage Area Locations*

Materials stored at the site during construction activities may include pipe sections, valves, supports, connectors, construction supplies, petroleum products, solvents, concrete, and other materials, as summarized in Table 6. Materials handling, loading, and storage areas will be located away from natural stormwater drainageways and/or will be surrounded with earthen, gravel-clad berms to prevent stormwater impacts. Areas used for construction materials and chemical storage will be kept covered to prevent stormwater impacts.

### *3.2.2 Description of Significant Material Storage*

During plant construction, chemical storage is expected to be minimal. Chemical containers will be covered and properly stored in areas where they will not come in contact with stormwater. Stockpiles of excavated soils will be bermed at base levels to prevent stormwater from transporting sediments into nearby drainages. Any fuel storage tanks for trucks, heavy construction equipment, or other purposes will be contained in prefabricated secondary containment structures or in an earthen, gravel-clad berm capable of containing the entire volume of the largest tank and sufficient freeboard to contain impounded stormwater. Additional specific recommendations for material storage and management are provided in Section 4.5 and Section 4.6.

**Table 6. Inventory of Potential Pollutants and Associated BMPs**

| Material Trade Name or Type of Activity | Applicable to Site? (Y or N) | Potential Pollutant | Associated BMP(s) |
|---|---|---|---|
| Glue, adhesives, epoxy powders | Y | Polymers, epoxies | Disposal of used containers must follow manufacturer specifications. Proper application (see manufacturer recommendations). Storage of products: properly sealed containers indoors, on a pallet, preferably under shelter or tarp, or inside a vehicle tool cabinet. |
| Asphalt | Y | Oil, petroleum distillates | Follow manufacturer application specifications. Disposal of used containers and excess material must follow manufacturer specifications. |
| Concrete, concrete washout water | Y | Limestone, sand, pH | Designated concrete washout tank or pit. Do not clean out hopper or chute onto ground or into drainage channels. Concrete washout area must be within a bermed containment area. It must be cleaned out when it reaches 75% capacity. Recommend cleanout at 50%. All washout areas will be in the site boundary. |
| Cleaning solvents | Y | Perchloroethylene, methylene chloride, trichloroethylene, petroleum distillates | Proper application (see manufacturer recommendations). Disposal of used containers and excess material must follow manufacturer specifications. Storage: tightly sealed containers indoors, or within a shed or truck toolbox. If product is stored outdoors, must be stored under a shelter or tarp, preferably within secondary containment. |
| Wood preservatives | N | Stoddard solvent, petroleum distillates, arsenic, copper, chromium, creosote, pentachlorophenol | Proper application (see manufacturer recommendations). Disposal of used containers and excess material must follow manufacturer specifications. Storage: tightly sealed containers indoors, or within a shed or truck toolbox. If product is stored outdoors, must be stored under a shelter or tarp, preferably within secondary containment. |
| Hydraulic oil/fluids (brake, power steering, etc.), greases, lubrication oils | Y | Mineral oil | Proper application (see manufacturer recommendations). Disposal of used containers and excess material must follow manufacturer specifications. Storage: tightly sealed containers indoors, or within a shed or truck toolbox. If product is stored outdoors, must be stored under a shelter or tarp, preferably within secondary containment. All on-site vehicles will be routinely inspected for leaks and drips. |
| Gasoline/diesel fuel | Y | Benzene, ethyl benzene, toluene, xylene, methyl tertiary butyl ether | Proper application (see manufacturer recommendations). Disposal of used containers and excess material must follow manufacturer specifications. Storage: tightly sealed containers indoors, or within a shed or truck toolbox. If product is stored outdoors, must be stored under a shelter or tarp, preferably within secondary containment. All on-site vehicles will be routinely inspected for leaks and drips. |
| Kerosene | N | Coal oil, petroleum distillates | Proper application (see manufacturer recommendations). Disposal of used containers and excess material must follow manufacturer specifications. Storage: tightly sealed containers indoors, or within a shed or truck toolbox. If product is stored outdoors, must be stored under a shelter or tarp, preferably within secondary containment. |

| Material Trade Name or Type of Activity | Applicable to Site? (Y or N) | Potential Pollutant | Associated BMP(s) |
|---|---|---|---|
| Antifreeze/coolant | Y | Ethylene glycol, propylene glycol, heavy metals (copper, lead, zinc) | Proper application (see manufacturer recommendations). Disposal of used containers and excess material must follow manufacturer specifications. Storage: tightly sealed containers indoors, or within a shed or truck toolbox. If product is stored outdoors, must be stored under a shelter or tarp, preferably within secondary containment. All on-site vehicles will be routinely inspected for leaks and drips. |
| Detergents | N | Phosphorous | Proper application (see manufacturer recommendations). Disposal of used containers and excess material must follow manufacturer specifications. Storage: tightly sealed containers indoors, or within a shed or truck toolbox. If product is stored outdoors, must be stored under a shelter or tarp, preferably within secondary containment. |
| Dust- or particulate-generating processes | Y | Dust, particulates | BMPs used on site to reduce the movement of dust and particulates include, but are not limited to, watering practices during earth-moving activities; the application of a chemical dust suppressant substance to bind the dirt to the earth during construction; speed limit controls to ensure minimal dust kick up produced by moving vehicles; ceasing any earth-moving activity during high wind. Other BMPs may be introduced on site during construction. |
| Drilling activities | N | Bentonite, diesel-based drilling muds, barium-based drilling muds, saline solutions (potassium chloride, calcium chloride) | Proper application (see manufacturer recommendations). Disposal of used containers and excess material must follow manufacturer specifications. Storage: mud storage tank/trailer, tightly sealed containers, placed on a pallet, use of plastic shrink-wrap, under shelter or tarp. Use of secondary containment practices. Use of a designated containment pit and/or a vacuum truck for removal from project site and/or reuse. Hay bales, wattles, and earthen berms are to be used for containment of bentonite releases. |
| Sediment | Y | Nutrients, suspended solids, sediment | Sediment erosion and sedimentation on site should be controlled by structural and non-structural BMPs. Structural BMPs can include, but are not limited to, sediment control logs, erosion-control blankets, riprap, earth berms, and silt fence. Non-structural BMPs can include, but are not limited to, seed and mulch, exposure time of disturbed soils, education of on-site personnel. |

## 3.3 Description of Significant Spills, Leaks, and Releases

The Bill Sanderson Gas Plant is a new construction and thus, any existing significant spills, leaks, or releases discovered prior to initiation of the proposed facility construction activities would be adequately addressed before construction commences. If petroleum hydrocarbon-impacted soil or other potentially hazardous conditions are discovered during soil excavation activities, an OE2 representative will be notified immediately. The OE2 SWPPP Team Administrator will evaluate the construction activity and existing safety and environmental hazards, and advise the contractor regarding future work efforts in that area. However, if soil contaminated with petroleum hydrocarbons such as diesel fuel, or if other potentially hazardous conditions are discovered during excavation activities, work will be stopped, and an assessment of the situation will be initiated. The type of contamination will be identified, and specific plans will be made to obtain approvals for removal, transport, and disposal of the contaminated soil or to modify the construction plans.

## 3.4 Potential Pollution Sources

It is the responsibility of the stormwater inspector to continually monitor and update the materials inventory in this SWPPP and to ensure that each identified potential pollutant has a BMP installed to prevent discharges.

### *3.4.1 Construction Materials*

Table 6 provides an inventory of potential materials that may be on site during facility construction and equipment installation activities as well as the potential pollutants associated with those materials and the BMPs that will be used on site to eliminate the possible discharge of pollutants.

### *3.4.2 Sediment*

The most common source of pollution from the plant construction area will be sediment, which can be carried away from the work site with stormwater runoff and impact the water quality of a receiving stream or wetland. Clearing, grading, and otherwise altering previously undisturbed land can increase the rate of soil erosion over pre-disturbance rates. Stockpiles of excavated soil and aggregate (soil, gravel, and similar materials) and access roads will also be constructed with erosion protection measures.

### *3.4.3 Petroleum Products*

Petroleum products can also be potential stormwater pollutants. These products are used in construction activities to power or lubricate equipment and include gasoline, diesel fuel, lubricant oils, hydraulic oils, used oils, brake fluid, grease, and solvents. Sources of petroleum product leaks include vehicle and equipment engines, fuel transfers, oil drips/leaks, and fuel from aboveground storage tanks. In addition, paints and solvents used to coat piping/equipment welds, sealants, emulsions, concrete, pesticides, and herbicides may be used in project activities. Mobile refuelers may frequently transfer fuel to on-site construction vehicles, equipment, and portable tanks.

### *3.4.4 Laydown Areas, Equipment Cleaning and Maintenance, and Solid Waste*

Debris from laydown areas, residue from equipment cleaning and maintenance, and solid waste generated from land clearing operations and human activity (trees, brush, paper, trash, etc.) represent other potential pollution sources within the construction site. Additionally, the project area may contain construction supplies such as pipe, culverts, empty tanks, drums and vessels, and fencing.

### *3.4.5 Human Waste/Chemical Toilets*

Chemical toilets will be provided for worker use during construction activities. The toilets will be conveniently located for worker use and ease of access, servicing, and maintenance by a third-party commercial vendor. The toilets will be securely fastened to the ground so they cannot be tipped over by the wind or by accident. Contained wastes will be routinely removed by the service contractor for disposal at an approved facility.

### *3.4.6 Concrete Washout Areas*

If concrete is used during plant construction activities, concrete truck washout waters will be managed to prevent them from being transported off site and reaching waters of the state. A designated concrete truck washout water tank or earthen pit will be installed at the site to capture and hold the water so it can evaporate. Concrete truck washout will only occur at this designated location. Dried and hardened solids will be removed, broken, and used to supplement gravel surfaces as needed or removed for disposal at an approved off-site facility.

# 4 STORMWATER MANAGEMENT CONTROLS

Stormwater management controls include both erosion and sediment controls and operational controls that are used to prevent or minimize stormwater impacts and control soil erosion and subsequent sedimentation. The use of a combination of physical BMPs, good work practices, and proper fuel, chemical, and materials storage practices will prevent or minimize stormwater impacts. The types and locations of physical BMPs to be used in the project area are shown on the BMP location maps (Appendix C), and BMP construction details and specifications presented in Appendix D illustrate how project construction will be executed.

## 4.1 Erosion and Sediment Control Requirements

The objective of erosion and sediment controls is to minimize the release of sediments to stormwater runoff. This can be accomplished using structural and operational controls to prevent stormwater run-on, enhance on-site stormwater containment and management, and reduce stormwater runoff volume and velocity.

Stormwater controls implemented at the site are selected to withstand and function properly during precipitation events up to the 2-year, 24-hour storm event, which in North Dakota ranges from 2.3 inches in the east to 1.9 inches in the west. If stormwater inspections or other information indicates that the selected stormwater control has been used inappropriately or incorrectly, the control will be replaced or modified within 24 hours or prior to the next rainfall event (whichever comes first) or as field conditions allow. All stormwater controls will be implemented in accordance with the manufacturer's specifications, unless justification is provided for a deviation from those requirements.

A 50-foot natural buffer or equivalent erosion and sediment control will be provided when project activities are within 50 feet of surface water and stormwater runoff flows to that surface water. If equivalent erosion and sediment controls are used, the rationale for using equivalent controls will be included in Appendix C.

Temporary soil stockpiles will have effective sediment controls implemented, and will not be placed in surface waters, including stormwater conveyances, drainageways, or ditches.

If off-site sediment transport occurs, any off-site accumulations will be removed in a manner and frequency that minimizes off-site impacts. If such off-site sedimentation occurs, the SWPPP will be modified accordingly to prevent further off-site sediment deposition.

The following commonly used erosion and sediment controls and practices will be implemented, as appropriate.

- Grade or extend terraces across slopes to prevent stormwater from flowing onto the construction area and plant open areas with native grasses or low-growing plants soon after work is completed.
- Place energy-dissipating material, such as riprap, check dams, straw bales, wattles, and/or gabions, at stormwater outfalls to slow water runoff, thereby minimizing erosion and preventing entrained sediments from entering waterways.
- Prevent erosion damage by using geotextiles or energy-dissipating devices such as check dams, gabions, or riprap along stream courses or their banks or drainageways that may be impacted by the construction.

- Armor culverts with inlet protection to prevent suspended particles from entering stormwater drainages.
- Maintain gravel entrance/exit pads at the construction site entrance/exit location to provide a buffer to reduce the amount of mud and soil transported on vehicle tires from the site to paved public roadways.
- Temporary or permanent erosion protection and stabilization (e.g., cover crop or mulching) will be implemented immediately for all exposed soil surface areas where activities have been completed or temporarily stopped for at least 14 days.

## 4.2 Selection of Structural Controls

Physical erosion and sediment controls that may be used at the construction site to minimize possible sediment impacts to stormwater runoff are described in the following sections. A number of different controls may be used at the construction site, either individually or in combination, to manage stormwater and minimize erosion and sedimentation. Specific BMP installation details and specifications are provided in Appendix D, and selection guidelines for each construction phase are summarized in Table 7.

**Table 7. BMP Selection Guidelines**

| BMP | Pre-Construction | Active Construction | Post-Construction |
|---|---|---|---|
| Berms | -- | X | -- |
| Check dams | -- | X | X |
| Diversion ditch or berm | -- | X | X |
| Drainage dip | -- | X | X |
| Erosion-control blanket | -- | X | X |
| Filter berm | -- | X | X |
| Level spreader | -- | -- | X |
| Mulching | -- | X | X |
| Revegetation | -- | X | X |
| Sediment trap | -- | X | -- |
| Silt fence | X | X | X |
| Slope stabilization | -- | X | X |
| Stabilized construction entrance | X | -- | -- |
| Stormwater detention pond | -- | X | X |
| Straw bale barrier | X | X | X |
| Straw wattles | X | X | X |
| Surface roughening | - | X | X |
| Terracing | -- | X | X |
| Vegetative buffer | X | X | X |
| Water bar | -- | X | X |

### *4.2.1 Berms*

A berm is a ridge of compacted soil located at the top or base of a sloping disturbed area to contain or divert surface runoff. Where used, soil berms will be constructed of soil with enough fines to minimize

flow through the berm. The purpose of a berm is to control runoff velocity, divert onsite surface runoff to a sediment trapping or filtration device, and/or divert clean water away from disturbed areas.

### 4.2.2 Check Dams

Check dams are small, temporary dams constructed across a diversion or roadside ditch. Check dams can be constructed using gravel, rock, gravel bags, geo-ridges, earth with erosion-control blanketing, straw bales, or wattles and are used to slow the velocity of concentrated flow in a channel. As a secondary function, check dams can also be used to catch sediment from the channel itself or from the contributing drainage area as stormwater runoff flows through or over the structure.

### 4.2.3 Diversion Ditch or Berm

A diversion ditch or berm is used to prevent sediment-laden stormwater runoff from leaving the construction site or disturbed area, to prevent flows from eroding slopes, and to direct sediment-laden flows to a trapping device. A diversion ditch or berm can also be used to divert surface runoff from upgradient areas away from the construction area.

### 4.2.4 Drainage Dip

Drainage dips intercept and remove surface water from the access roads, facilities, pipelines, and roadside ditches before the combination of water volume and velocity begin to erode the structures. Drainage dips are constructed diagonally across the flow of the surface water and tend to reduce the speed of vehicles, while dispersing surface water.

### 4.2.5 Erosion-Control Blankets

Erosion-control blankets and turf reinforcement mats are porous fabrics and are manufactured by weaving or bonding fibers made from organic or synthetic materials. Erosion-control blankets are installed on steep slopes, over berms, or in channels to prevent erosion until final vegetation is established. Erosion-control blankets can also be used as separators or to aid in plant growth.

### 4.2.6 Filter Berm

A filter berm is a temporary ridge made of natural materials that already occur on the project site. Brush filter berms use small tree branches, root mats, grass, leaves, stone, or other debris or material naturally available or left over from the site clearing and grubbing. Rock filter berms use site gravel, stone, or rock. Both types of filter berms are placed along a level contour to slow, filter, and divert flow and act as an efficient form of sediment control.

### 4.2.7 Level Spreader

A level spreader is used to prevent erosion and to improve infiltration by spreading concentrated stormwater runoff evenly over the ground as shallow sheet flow instead of through channels. It usually involves a depression in the soil surface that disperses flow onto a flatter area across a slight slope and then releases the flow onto level, vegetated areas. This reduces flow speed and increases infiltration and promotes evaporation.

### 4.2.8 Mulching

Mulching is a temporary erosion-control practice in which materials such as grass, straw, hay, wood fibers, or wood chips are placed or implanted into soils on exposed or recently planted soil surfaces. Mulching stabilizes soils by minimizing rainfall impact and reducing stormwater runoff velocity. When mulching is used in combination with seeding, surface soils retain moisture, promote seed germination, and help insulate roots from extreme temperatures.

### 4.2.9 Revegetation

Revegetation involves planting seed to establish a vegetative cover on disturbed areas to reduce erosion by stabilizing disturbed areas. It also reduces runoff volumes by increasing water percolation into the soil, binds soil with roots, and protects soil from wind erosion. The permanent seed mixture, rate, application method, and supplemental materials will be selected in coordination with the revegetation contractor and the Williams County NRCS office.

### 4.2.10 Sediment Trap

Sediment traps are intended to intercept, trap, and retain sediment from runoff while allowing detained runoff to slowly drain, infiltrate, or both. They are usually installed in a drainageway or other point of discharge from a disturbed area and are formed by excavating below grade and/or constructing an earthen embankment with a protected spillway to slow the release of runoff.

### 4.2.11 Silt Fence

Silt fences are temporary perimeter control structures designed to slow, temporarily impound, and filter sediment-laden water. Installation technique and maintenance is critical to proper performance.

### 4.2.12 Slope Stabilization

The use of appropriate materials, such as mulch, staked sod, riprap, erosion-control blanket, or other materials that prevents erosion on slopes from occurring.

### 4.2.13 Stabilized Construction Entrance

A stabilized construction entrance is a pad of gravel laid over filter cloth where construction traffic will be entering or leaving a construction site to or from a public right-of-way, street, or highway. The purpose of a stabilized entrance to a site is to minimize the amount of tracked mud and dust that leaves the site. As a vehicle drives over the gravel, mud and sediment are removed from the vehicle's wheels and offsite transport of soil is reduced. This BMP reduces erosion and tire rutting, and the filter fabric separates the gravel from the soil below by minimizing gravel migration into the subsurface soil caused by heavy vehicle loads. A stabilized construction entrance should be used at facility ingress and egress locations.

### 4.2.14 Straw Bale Barrier

A straw bale barrier is a series of entrenched and staked straw bales placed on a level contour to intercept sheet flows. The barrier reduces runoff velocity and filters sediment-laden runoff from small drainage areas of disturbed soil and may also be used to protect against erosion in small, shallow drainage channels.

### 4.2.15 Straw Wattles

Straw wattles or rolls are intended to capture and keep sediment on slopes or in small shallow drainage channels. Straw rolls can be used to temporarily stabilize slopes by reducing soil creep, and sheet and rill erosion, until permanent vegetation can be established. Straw rolls will last an average of 1 to 2 years.

### 4.2.16 Surface Roughening

Soil surface roughening is a temporary erosion-control practice often used in conjunction with grading. Soil roughening involves increasing the relief of a bare soil surface with horizontal grooves (corrugating) or tracks (tracking) using construction equipment. Slopes that are not fine-graded and that are left in a roughened condition can reduce erosion, trap sediment, and prepare ground surfaces for seeding.

### 4.2.17 Terracing

Terraces are made of either earthen embankments or ridge and channel systems that are properly spaced along a fill slope. Terraces are constructed with an adequate grade to promote drainage to a stabilized outlet. They reduce damage from erosion by collecting and redistributing surface runoff to stable outlets at slower speeds and by decreasing the distance of overland runoff flow. They also surpass smooth slopes in holding moisture and help to minimize sediment loading of surface runoff.

### 4.2.18 Vegetative Buffer

Vegetative buffers are areas of either natural or established vegetation that are maintained to protect the water quality of neighboring areas. Vegetative buffers reduce stormwater runoff velocity, prevent soil erosion, promote infiltration, and act as a filter to remove sediment. Vegetated buffers will have a minimum width of 1 foot for every 5 feet of disturbed area that drains to the buffer. The width of the buffer will have a slope of 5% or less and the area draining to the buffer will have a slope of 6% or less. Buffers will consist of dense grassy vegetation, 3 to 12 inches tall, with a uniform coverage area greater than 90% and less than 10% composed of woody vegetation.

### 4.2.19 Water Bar

A water bar is an earthen ridge, or ridge and channel, constructed diagonally across the slope of a road, trail, or disturbed area. Water bars are normally used for drainage and erosion protection of closed, blocked, or infrequently used roads to divert stormwater runoff and minimize erosion.

### 4.2.20 Stormwater Detention Pond

A stormwater detention pond is designed to capture the runoff from a specific disturbed area for a certain precipitation intensity, provide for entrained sediment to drop out of the water in the pond, and then discharge relatively sediment-free water from the pond (see Appendix D).

## 4.3 Operational Controls

### 4.3.1 Dust Control

Wind can cause erosion, particularly in dry climates or during the dry season. Wind erosion can occur where surface soil is loose and dry. Wind erosion may also occur in areas where vegetation is sparse or

absent and can transport sediments to where they can be washed into receiving waters during the next storm event or snowmelt runoff.

The prevailing winds in western North Dakota are generally from the northwest, although a southeasterly wind direction occurs occasionally. The excavated topsoil, ground cover, and overburden materials will be stockpiled for future reuse during dry cuttings pit closure activities and final site reclamation. If possible, these stockpiles should be laid out perpendicular to the predominant wind direction to serve as wind breaks and vegetated cover should be established to minimize erosion.

During construction, disturbed areas, excavated materials, soil piles, and stockpiled materials will be watered regularly to minimize fugitive dust. Access roads associated with the construction activities will also require frequent watering or use of chemical dust suppressants to prevent fugitive dust from blowing offsite.

### *4.3.2 Construction Site Housekeeping*

Housekeeping will consist of neat and orderly storage of materials and containerized fluids. Wastes will be temporarily stored in sealed containers and regularly collected and disposed of at off-site, suitable facilities. If spills occur, prompt cleanup is required to minimize any commingling of waste materials with stormwater runoff.

Cleanup of trash and discarded materials will be conducted at the end of each workday. Cleanup will consist of patrolling the roadway, access areas, and other work areas to pick up trash, scrap debris, other discarded materials, and any contaminated soil. These materials will be disposed of appropriately.

Deposited sediment will be removed from paved surfaces, using loaders, shovels, and/or brooms, by the end of the workday or within 24 hours of tracking the sediment

### *4.3.3 Operations and Maintenance Techniques*

Developing and implanting operations and maintenance techniques help ensure that the SWPPP requirements are carried out on a regular basis and in a manner that is compliant with the general stormwater permit conditions. Some of these operations and maintenance techniques are outlined below.

- Develop and maintain inspection schedules; correct deficiencies noted during these inspections; clean and maintain stormwater management system components.
- Perform routine trash collection and disposal, and grounds maintenance.
- Dispose of trash generated by project activities at a suitable solid waste disposal facility.
- Familiarize employees with good housekeeping procedures, tips, reminders, and pollution prevention concepts.

### *4.3.4 Petroleum Products, Material Storage, and Management*

Petroleum products that may be present at the construction site include gasoline, diesel fuel, lubricant oils, hydraulic oils, used oils, and solvents. Gasoline and diesel fuel will be stored in portable storage tanks with secondary containment. Lubricant, hydraulic, and miscellaneous oils and solvents will be stored in 55-gallon or smaller containers within a secondary containment area or in approved tool and equipment sheds or other protected structures.

Routine maintenance will be limited to fueling and lubrication of equipment. Drip pans, mats, or similar methods will be used during routine fueling and maintenance to contain spills or leaks. Any waste product from maintenance will be containerized and transported offsite for disposal or recycling. No major equipment overhauls will be conducted within the project area. Equipment will be transported offsite for major overhauls.

Pollutants from petroleum products used during construction activities adhere easily to soil particles and other surfaces. In case of a spill or leak, soils contaminated with petroleum products will be contained and removed to a proper disposal site. Soil erosion and sediment control practices will aid in retention of spills or leaks. Maintenance and safe storage practices will reduce the chance of petroleum products contaminating the project area. Oily wastes such as crankcase oil, cans, rags, and paper containing oils will be placed in proper receptacles and disposed of or recycled. An additional source of petroleum contamination is leaks from equipment and vehicles. Routine daily inspections will be conducted to identify leaks and initiate corrective actions, if needed.

### *4.3.5 Petroleum Product Storage and Management Guidelines*

The following guidelines for storing and managing petroleum products will be used.

- All product containers will be clearly labeled and stored in areas away from vehicle traffic.
- All drums will be kept off the ground within secondary containment, labeled, securely fastened, and stored under cover if needed.
- Bulk storage fuel tanks will be stored within secondary containment.
- Emergency spill response procedures/materials will be available at the project area. Persons trained in handling spills will always be on call.
- Employees will be familiar with the storage locations for spill cleanup equipment and trained in the use of spill cleanup equipment.
- Spill cleanup and containment materials (absorbent, shovels, etc.) will be easily accessible. Spills will be immediately cleaned up and contaminated materials will be properly stored on site until they can be disposed of in accordance with applicable regulations.
- Storage areas and containers will be regularly monitored for leaks and repaired or replaced as necessary. Contractors and subcontractors should be reminded about proper storage, handling, and transferring of petroleum products or other hazardous materials during safety meetings.
- Chemical substances used at the site will be identified, properly labeled, and inventoried, and the Material Safety Data Sheets will be kept on file.

A hazardous substance release in any amount which enters or threatens to enter waters of the state shall be reported to the National Response Center and to the NDDEQ. Refer to Table 2 for notification information.

State reportable spills and/or releases of petroleum products/materials that result in a visible sheen on water, or a visible deposit on the bottom or shoreline of any waterbody must be reported to the NDDEQ at 701-328-5210 as soon as practical after discovery. A NDDEQ General Environmental Incident Report Form should be used for any environmental incident or release that is not exempt under Resource Conservation and Recovery Act oilfield exemptions.

### *4.3.6 Employee and Contractor Training*

OE2 will implement a training program to address the areas of concern listed below. All employees, including contractors and subcontractors, will be trained to ensure proper awareness and implementation of stormwater management controls. Training will cover the following topics.

- Purpose and requirements of the stormwater permit.
- Components of the SWPPP and stormwater regulations.
- Stormwater management controls.
- Inspections, recordkeeping, and reporting.
- Stormwater and non-stormwater discharges.
- Changes to the SWPPP.

Records of the training, including the topics discussed, attendees, and an evaluation of BMPs in use, will be maintained and kept at the OE2 Denver, Colorado, offices for a minimum of 3 years. A Training Log to document training is provided in Appendix E.

### *4.3.7 SWPPP Revisions*

This SWPPP is a working document and will be modified as necessary when there are changes in the design, construction, and operation or maintenance activities during the life of the construction project or until final stabilization is achieved. Updates and revisions to the SWPPP will be made as soon as practicable. Errors in paperwork, changes to BMPs, or the removal, addition, or adjustment of erosion and sediment control measures must be made to the SWPPP or appropriate site maps. Revisions and updates to this SWPPP will be recorded on the SWPPP Amendment Log included in Appendix A.

### *4.3.8 Inspection and Maintenance Procedures*

See Section 5.0 for a discussion of inspection and maintenance procedures.

### *4.3.9 Recordkeeping Procedures*

See Section 6.0 for a discussion of recordkeeping procedures.

### *4.3.10 Other Operational Controls*

Other operational controls include implementing stormwater controls before beginning construction; considering predominant wind directions, soil types, topography, and drainage features in project design; prohibiting or modifying work practices that may cause or increase erosion; and scheduling work for times of the year or times of the day when precipitation is less likely.

## 4.4 Stabilization Requirements

To meet the permit conditions, stabilization means that the exposed ground surface will be covered by appropriate materials, such as mulch, staked sod, riprap, erosion-control blankets, or other material that prevents erosion from occurring on the exposed surface. Grass seeding alone does not constitute stabilization, nor does snow cover and/or frozen ground conditions.

If stabilization requirements cannot be met due to circumstances beyond control of OE2, the following actions will be implemented.

- If vegetative stabilization is to be used, immediately initiate, and within 14 calendars days complete the installation of temporary non-vegetated stabilization; or
- Complete all methods of initiating stabilization as soon as conditions or circumstances allow.

If any above conditions are encountered, OE2 will document the circumstances that prevented achieving the stabilization requirements contained in this SWPPP and will provide a schedule to be followed to meet the stabilization requirements.

### *4.4.1 Steep Slopes*

For all steep slopes, with a grade equal to or greater than 15% (6.7:1 [horizontal:vertical]), stabilization will be initiated immediately once activities have been completed or temporarily ceased. Stabilization will be completed as soon as practicable, but no later than 7 calendar days after the initiation of soil stabilization.

### *4.4.2 Exposed Areas*

All exposed soil areas will be stabilized, and stabilization will be initiated immediately where activities have been permanently or temporarily ceased on any portion of the site and will not resume for a period exceeding 14 calendar days. Stabilization will be completed as soon as practicable, but no later than 14 calendar days after the initiation of soil stabilization activities. Temporary stockpiles without significant silt, clay, or organic components (e.g., clean aggregate stockpiles, demolition concrete stockpiles, sand stockpiles) will not be stabilized.

### *4.4.3 Frozen Ground Conditions*

OE2 will implement winter stabilization methods during frozen ground conditions, if the site was not stabilized prior to the ground freezing.

### *4.4.4 Diversion Ditches with Continuous Flows*

Stream diversions or any temporary or permanent drainage ditches that will have a continuous water flow will be stabilized with appropriate controls prior to connection with any surface water. The entire area (channel and bank) of the diversion ditch will be appropriately stabilized to bankfull height.

The normal wetted perimeter of any temporary or permanent drainage ditch that conveys water from the project site, or diverts water around the site, will be stabilized at least 200 linear feet from the project or property boundary, or from the point of discharge to any surface water. Stabilization of the conveyance will be completed prior to connection with a surface water. Any remaining portion of the temporary or permanent drainage ditch must be stabilized within 14 calendar days for portions which construction activities have temporarily or permanently ceased.

## 4.5 Chemical Treatment

While not anticipated, if chemical treatment is to be used for sediment removal, it will be used in accordance with the manufacturer's specifications. Treatment chemicals will be selected in consideration of the anticipated soil particle size and stormwater characteristics (e.g., pH, turbidity, stormwater flow

rate into the chemical treatment system, etc.) and a description of the chemical treatment process will be included herein.

If chemical treatment will be pursued, OE2 will comply with the following.

- OE2 will submit a written request to the NDDEQ for review and approval to ensure that the selection and management of chemicals will minimize the potential for harmful effects from the discharge.
- The request to discharge chemically treated stormwater will be submitted 60 days prior to the anticipated usage date and will include all of the following information.
    - Material Safety Data Sheet/Safety Data Sheet
    - Proposed water additive discharge concentration
    - Discharge frequency (i.e., number of hours per day/number of days per year)
    - Proposed discharge monitoring point
    - Type of treatment, if any, to remove additive prior to discharge
    - Product function (e.g., coagulant, flocculant, etc.)
    - A 48-hour LC50 or EC50 for a North American freshwater planktonic crustacean (*Ceriodaphnia* sp., *Daphnia* sp., or *Simocephalus* sp.)
    - Toxicity test results for one other North American freshwater aquatic species (other than a planktonic crustacean)
- OE2 understands that any discharges from the chemical treatment of stormwater must not cause a violation of the standards of quality for waters of the state and that the discharge must be consistent with the dewatering requirements of Part II(C)(3)(g) of the general permit and Section 2.6 of this SWPPP.

## 4.6 Final Stabilization

Achieving final stabilization for the site ensures that stormwater runoff from the site will not result in soil erosion and sedimentation, will not contribute pollutants to waters of the state, and will not contravene water quality standards. Implementation of this SWPPP will continue until the final stabilization criteria, as specified in Part II, Section E of the General Permit and outlined below, have been met and a NOT has been submitted to the NDDEQ.

Final stabilization can be achieved in three different ways.

1. All soil-disturbing activities have been completed and all soils have been stabilized by a uniform perennial vegetative cover, with a density of 70% of the pre-existing cover over the entire pervious surface area, or other equivalent means necessary to prevent soil failure under erosive conditions, and:
    a. all drainage ditches constructed to drain water from the site after construction is complete have been stabilized to prevent erosion;
    b. all temporary erosion and sediment control BMPs (e.g., silt fence) have been removed; and
    c. all sediment has been removed from conveyances and temporary sedimentation basins that will be used as permanent water quality management basins. Removed sediment will be stabilized to prevent it from being washed into basins, conveyances, or drainageways

and discharging off-site or to surface waters. Permanent basins must be sufficiently cleaned out to return the basin to design capacity.

2. In areas of the state where the average annual rainfall is less than 20 inches, all soil-disturbing activities have been completed and erosion-control measures (e.g., degradable rolled erosion-control products) and stabilization methods have been selected, designed, and installed, along with an appropriate seed mixture, to provide erosion control for at least 3 years and achieve 70% of the pre-existing vegetative cover within 3 years, without active maintenance, so that the site meets the criteria outlined in items 1 a, b, and c, above.

3. Disturbed areas on land used for agricultural purposes that are restored to their pre-construction agricultural use do not have to meet the foregoing final stabilization criteria. If the construction activity removed a standing crop, the area must be restored in accordance with the landowner's requirements.

   Disturbed areas that were not previously used for agricultural activities, such as buffer strips immediately adjacent to state waters and areas that are not being returned to their pre-disturbance use, must meet the final stabilization criteria listed in items 1 or 2 above.

## 4.7 Local Requirements

The Williams County Water Resource District Storm Water Management Plan regulations were addressed through the submission and granting of a de minimus effect review which revealed that post-construction peak flow discharges from the site will be slightly less than pre-construction peak flows for the 60-minute duration 100-year return frequency storm event.

## 4.8 Spill Response Plans

Contractors and subcontractors working on-site will have individual spill control and response plans or conform to OE2's spill control and response plan, as outlined herein. A minimum of one Spill Response Kit (see Table 8) will be available from the Construction Superintendent at all times.

**Table 8. Spill Response Kit Contents**

| Quantity | Item |
|---|---|
| **Booms and Sorbent Materials** | |
| 4 | 5-inch × 10-foot absorbent booms |
| 100 | 17 × 19-inch absorbent pads |
| 3 | 50-pound bags of sorbent material |
| **Personal Protective Equipment** | |
| 2 | Pair of gloves |
| 2 | Pair of safety glasses |
| 2 | Protective coveralls |
| **Equipment** | |
| 1 | Flat-bladed non-sparking shovel |
| 1 | Box heavy duty (3 mil) garbage bags |

### *4.8.1 Spill Response Procedure*

In the event of a spill, leak, or release, the following procedure will be implemented.

- Account for personnel, assure their safety, and evacuate if a fire, explosion, or exposure hazard exists.
- Remove all sources of ignition. Position fire suppression equipment. Alert the OE2 Construction Manager, SWPPP Team Coordinator, or on-site inspector, who will contact the local fire department, if necessary.
- Shut off pumps and close valves that allow oil to flow to the segment of the system causing the spill. Plug or patch leak/discharge if possible.
- The OE2 Construction Manager or SWPPP Administrator will alert adjacent property owners/operators, as warranted by the incident.
- As safety allows, attempt to contain the spill. Prevent or divert spilled oil from approaching structures or draining toward water or storm drains. Absorbent material, spark-proof shovels, brooms, neoprene gloves, and other spill response materials are kept in the Spill Response Kit that is stored at the site.
- The OE2 Construction Manager or SWPPP Administrator will conduct a safety assessment and determine additional cleanup actions as needed.

For all occurrences, the OE2 Construction Superintendent or SWPPP Administrator will evaluate the incident and determine if notification is necessary. If a reportable quantity spill occurs, the SWPPP will be amended to include a description of the spill, equipment changes, and/or operational changes required to prevent a recurrence.

### *4.8.2 Disposal of Recovered Materials*

Waste oil, oily material, or other potentially contaminated material recovered from spill cleanup operations will, in every case, be disposed of in a manner approved by the local, state, and federal agencies. Permits required for disposal vary on a case-by-case basis depending on type, volume, and condition of the material to be disposed. The designated OE2 Construction Superintendent or SWPPP Administrator is responsible for arranging the disposal of all recovered oil, contaminated absorbents, and other oily or contaminated debris.

The following disposal methods for recovered materials may be used by OE2.

- Off-site bioremediation, or off-site disposal for contaminated soils.
- Off-site disposal for liquids and surface water recovered from impacted surface waters.
- Off-site disposal of wastes generated from recovery activities.

# 5 INSPECTION AND MAINTENANCE PROCEDURES

Inspection and maintenance of erosion and sediment controls will occur during all phases of the project, as described in Section 2.3. Continued inspection and maintenance are required for specific erosion and sediment controls after construction is completed until final stabilization is achieved. Additionally, inspections will identify potential sources of pollutants that could impact stormwater discharges.

## 5.1 Stormwater Inspection Procedures

The stormwater inspection program will include the following.

1. A trained and qualified person familiar with this SWPPP and stormwater controls will conduct facility inspections by completing the Stormwater Inspection and Maintenance Form included Appendix F. The form will summarize the scope of the inspection, the name of the inspector, date of the inspection, the functional condition of the stormwater controls, and recommended corrective actions, if any.
2. Inspections will cover the following.
    - Disturbed areas without stabilization, slopes, and berms.
    - Material and chemical storage areas, perimeter runoff.
    - Straw bales, wattles, riprap areas, culverts, and settling ponds.
    - Surface water diversions and downgradient areas.
    - Culverts and inlet protection, check dams, and silt fences.
    - Perimeter runoff and stormwater outfalls.
    - New access roads, ditches, water bars, and surface diversions.
    - Locations where vehicles enter or exit the site.

    Inspections of the site and adjoining land area may need to be separated into several segments such as the following.

    - Access roads and site perimeters.
    - On-site construction, development, and installation activities.
    - Material and fuel storage areas.
3. Inspections will occur every 14 calendar days during active construction and within 24 hours (or the next business day) after a 0.25-inch or greater precipitation event or snowmelt event that causes or may cause surface erosion. For multiple-day precipitation events, inspections will be performed within 24 hours or the next business day after rainfall of 0.25 inch or greater occurs within a 24-hour period, even if it is still precipitating. At the conclusion of the extended rainfall event, another inspection will be performed within 24 hours or the next business day.
4. Post-construction inspections of areas that have been stabilized, but do not meet the final stabilization criteria, will occur every 30 days. Inspections will continue until final stabilization is achieved and a NOT has been filed with the NDDEQ.
5. A log of inspections will be completed and maintained in OE2's Denver, Colorado, offices for a minimum of 3 years.
6. Inspections are not required for disturbed areas when snow cover exists or the ground is frozen, provided that melting conditions do not exist.

7. Water quality will be visually assessed for all receiving streams or wetlands and discharge areas during each inspection, if present.
8. Disturbed areas and material storage areas that are exposed to precipitation will be inspected for evidence of pollutants entering nearby drainages.
9. Check dams, straw wattles, and other BMPs will be inspected for evidence of deterioration, under-cutting, and buildup of sediment. Sediment will be removed when it has built up one-third to one-half of the height of the specific control structure, as discussed in Section 5.2.3 and specified in Appendix C.
10. Roads used for vehicle access will be inspected for formation of rills and channels and for evidence of off-site sediment transport.
11. The results of the inspections will be used to update and revise the list of potential pollutant sources identified in Section 3.2.
12. This SWPPP will be modified as necessary whenever there is a change in project design, construction, or operation that changes the potential for pollutant discharge to waters of the state.
13. An inspection report summarizing the scope of the inspection, the name of the person conducting the inspection, date of inspection, and observations relating to the inspection will be prepared using the inspection and maintenance form included in Appendix F.
14. Actions taken to modify stormwater control measures will be recorded and maintained with this SWPPP. Revisions to the SWPPP will be performed as soon as practicable, but no later than 72 hours after the corrective actions have been identified.
15. If no deficiencies are found during the inspection, the report will contain a certification statement that the site is in compliance with this SWPPP.

## 5.2 Maintenance and Corrective Action Procedures

### *5.2.1 Personnel*

Personnel performing the stormwater inspections will record site conditions, BMP status, and recommended corrective actions on the Stormwater Inspection and Maintenance Form included in Appendix F. The SWPPP Team Coordinator will be apprised immediately of any discovered deficient conditions and recommended corrective actions. The SWPPP Team Coordinator will direct designated personnel (e.g., employees or subcontractors) to perform BMP maintenance, replacement, or new installation activities.

### *5.2.2 Scheduling*

Corrective actions for erosion- and sediment-control structures that are found to be performing inadequately or deteriorating will be performed before the next significant rainfall event (i.e., $\geq$0.25 inch) or within 24 hours (whichever comes first) or as field conditions allow. Rill or gully surface erosion and steep slopes (i.e., $\geq$15% slope) will be immediately repaired and stabilized. The SWPPP Team Coordinator has the authority and will direct subcontractors to install new and/or additional stormwater-control BMPs as needed.

### *5.2.3 Maintenance/Corrective Action Requirements*

All control devices like, and including, silt fences or fiber rolls must be repaired, replaced, maintained, or supplemented when they become nonfunctional (e.g., torn from posts, visible tears, eaten, etc.). Collected sediment must be removed as it approaches one-half of the aboveground capacity of the control device.

- Fiber rolls/straw wattles must be replaced when one-half of the original aboveground height of the device when it was installed has been lost as a result of flattening, other damage, or sediment build-up.
- Sedimentation basins must be drained, and the sediment removed when the depth of sediment collected in the basin reaches one-half the storage volume. Drainage and removal must be completed within 72 hours of discovery, or as soon as field conditions allow. Documentation must be provided in the maintenance records if field conditions do not allow access along with a plan of action for performing maintenance activities.
- Maintenance and cleaning of inlet protection devices must be performed when sediment accumulates, the filter becomes clogged, and/or performance is compromised.
- Surface waters, including drainage ditches and conveyance systems, must be inspected for evidence of sediment deposited by erosion. All deltas and sediment deposits in surface waters, drainageways, catch basins, and other drainage systems must be removed as soon as practicable.
- Areas where sediment removal results in exposed soil must be stabilized. Removal and stabilization will take place immediately, but no more than 7 calendar days after the discovery, unless precluded by legal, regulatory, or physical access constraints.
- If precluded, removal and stabilization will take place immediately, but no more than 7 calendar days after obtaining access. OE2 is responsible for contacting all local, regional, state, and federal authorities, and receiving any applicable permits prior to conducting any work.
- Vehicle tracking of sediment from the site must be minimized by BMPs, which may include having a designated egress with aggregate surfacing from the site or by designating off-site parking. OE2 will be responsible for (or make arrangements for) street sweeping and/or scraping of paved roads/highways, if BMPs are not adequate to prevent sediment from being tracked onto the paved road/highway surface.
- Accumulations of tracked and deposited sediment will be removed from all off-site paved surfaces by the end of the workday or shift, or if applicable, within a shorter time specified by local authorities or the North Dakota Department of Health.
- If sediment escapes the construction site, off-site accumulations of sediment will be removed in a manner and at a frequency to minimize off-site impacts.
- Vegetative buffers must be inspected for proper distribution of flows, sediment accumulation, and signs of rill formation. If a buffer becomes silt covered, contains rills, or is otherwise rendered ineffective, other control measures will be implemented. Eroded areas will be repaired and stabilized within 24 hours of discovery, or as soon as field conditions allow. Documentation will be provided in the maintenance records if field conditions do not allow access along with a plan of action for performing maintenance activities.

# 6 RECORDKEEPING PROCEDURES

Records of project inspections, spills, and maintenance activities will be maintained by OE2 at their Denver, Colorado, offices and at the site construction trailer, and will be included with this SWPPP as Appendix G. If a reportable-quantity petroleum hydrocarbon spill occurs, an Oilfield Related Environmental Incident Report will be filed electronically through the North Dakota Industrial Commission's website at: https://www.dmr.nd.gov/oilgas/spills/reportspill.asp. For a general environmental incident or non-exempt oilfield incident, a General Environmental Incident Report Form will be filed electronically through the NDDEQ's website at: http://https://deq.nd.gov/eir/NonOilField.

Records and reports will be maintained for a period of at least 3 years or until final stabilization is achieved and the stormwater permit is canceled or terminated.

# 7 NON-STORMWATER DISCHARGES

Non-stormwater discharges are not expected from plant construction or equipment installation activities, with the following possible exceptions: fire prevention/suppression activities, hydrostatic testing, and potable water used for dust control and watering seeded areas to promote germination. The intent is that potable water will remain within the disturbed areas of the project area and not run off or be discharged to receiving waters or wetlands. Stormwater will leave the project area along the ground surface via natural drainage swales or constructed ditches, and not through sewers or other buried piping; therefore, non-stormwater discharges are unlikely to occur once the project construction and equipment installation activities are completed.

# 8 CERTIFICATIONS

## 8.1 Owner/Applicant Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

By: Grant Burchell

Title: Senior Vice President, Engineering and Operations

Signature: _____

Date: MARCH 9, 2020

Owner Home Office Address: OE2 North LLC
1200 Seventeenth Street, Suite 900
Denver, Colorado 80202

## 8.2 Contractor/Subcontractor Certification

All contractors and subcontractors that will perform construction activities that could impact stormwater will be familiar with the SWPPP and will sign the following certification.

I certify under penalty of law that I understand the terms and conditions of the Bill Sanderson Gas Plant SWPPP and associated NDDEQ Construction Permit NDR100000 that authorizes stormwater discharges associated with the construction of this site.

Signature: _____

Name: _____

Title: _____

Date: _____

Representing:

Company: _____

Address: _____

Address: _____

Phone: _____

Work to be conducted:

Activity 1: _____

Activity 2: _____

Activity 3: _____

Activity 4: _____

# 9 LITERATURE CITED

Freers, T.F. 1970. *Geology and Ground Water Resources, Williams County, North Dakota. Part I – Geology*. Grand Forks: North Dakota Geological Survey.

Natural Resources Conservation Service (NRCS). 2020. Web Soil Survey. Available at: https://websoilsurvey.nrcs.usda.gov/app/HomePage.htm. Accessed February 6, 2020.

North Dakota Department of Environmental Quality (NDDEQ), Division of Water Quality. 2020. Seneral Stormwater Construction Permit (NDR10-0000). Available at: https://deq.nd.gov/publications/wq/2_NDPDES/Stormwater/Construction/NDR10_per_20150401F.pdf. Accessed February 28, 2020.

North Dakota Department of Health. 2018. *North Dakota 2018 Integrated Section 305(b) Water Quality Assessment Report and Section 303(d) List of Waters Needing Total Maximum Daily Loads.* Available at: https://deq.nd.gov/publications/WQ/3_WM/TMDL/1_IntegratedReports/2018_Final_ND_Integrated_Report_20190426.pdf. Accessed February 24, 2020.

# APPENDIX A

# NOTICE OF INTENT

# NDPDES GENERAL PERMIT FOR STORMWATER DISCHARGES FROM CONSTRUCTION ACTIVITY (NDR 100000)

# PERMIT COVERAGE LETTER

# DELEGATION OF AUTHORITY LETTER

# SWPPP AMENDMENT LOG

# NOTICE OF INTENT

**COPY OF NOTICE OF INTENT TO BE INSERTED**

# NDPDES GENERAL PERMIT FOR STORMWATER DISCHARGES FROM CONSTRUCTION ACTIVITY (NDR 100000)

Permit No: NDR10-0000
Effective Date: April 01, 2015
Expiration Date: March 31, 2020

AUTHORIZATION TO DISCHARGE UNDER THE

NORTH DAKOTA POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with Chapter 33-16-01 of the North Dakota Department of Health rules as promulgated under Chapter 61-28 (North Dakota Water Pollution Control Act) of the North Dakota Century Code,

Facilities both qualifying for and satisfying the requirements identified in Part I of the permit

are authorized to discharge stormwater associated with **construction activity**

to waters of the state

in accordance with conditions set forth in this permit.

This permit and the authorization to discharge shall expire at midnight,

March 31, 2020.

Signed this 31 day of March, 2015.

Karl H. Rockeman, P.E.
Director
Division of Water Quality

BP 2014.06.12

## Table of Contents

# I. PERMIT COVERAGE AND LIMITATIONS

## A. Discharges Covered

1. This permit applies to all areas within the state of North Dakota, except for those areas defined as Indian Country. Construction activity located within Indian Country within the state of North Dakota must obtain a permit through the United States Environmental Protection Agency. If the construction activity is located with the jurisdiction of the state of North Dakota, and the United States Environmental Protection Agency, a permit must be obtained from both regulatory entities.

2. This permit applies to stormwater discharges associated with construction activity and small construction activity as defined in Title 40 of the Code of Federal Regulations (CFR), Parts 122.26(b)(14)(x) and (b)(15), respectively. The reference to construction activity in this permit includes both large construction activity and small construction activity as described below.

    a. Large construction activity includes clearing, grading and excavation, that disturbs land of equal to or greater than five (5) acres and includes the disturbance of less than five (5) acres of total land area that is a part of a larger common plan of development or sale if the larger common plan will ultimately disturb five (5) acres or more.

    b. Small construction activity includes clearing, grading and excavation, that disturbs land of equal to or greater than one (1) acre, and includes the disturbance of less than one (1) acre of total land area that is part of a larger common plan of development or sale if the larger common plan will ultimately disturb equal to or greater that one (1) and less than five (5) acres.

    c. Discharges of stormwater from oil and gas exploration, production, processing or treatment operations, or transmission facilities composed of contaminated runoff by contact with or that has come into contact with, any overburden, raw material, intermediate products, finished product, byproduct, or waste products located on the site of such operations.

3. Stormwater discharges from support activities (e.g., equipment staging yards, material storage areas, excavated material disposal areas, borrow areas) may be covered by this permit as part of a related construction site. The support activities may only be in association with one project. If the support activity is associated with more than one project, a separate stormwater permit (Industrial or mining, extraction or paving material preparation) is required.

4. Certain non-stormwater discharges from facilities covered by this permit and meeting the requirements specified in Part II(A).

5. Stormwater discharges from construction activity covered by the previous permit, issued October 12, 2009, where a notice has been submitted to obtain coverage under this permit.

6. Projects which have obtained coverage under this permit shall amend and implement a Stormwater Pollution Prevention Plan (SWPPP) that meets the requirements of this permit within ninety (90) days of the effective date of this permit.

7. Discharges from dewatering activities related to construction activities (discharges of uncontaminated stormwater).

8. Local Authority. This permit does not preempt or supersede the authority of local agencies or operators of municipal separate storm sewer systems to prohibit, restrict, or control discharges of stormwater to storm sewer systems or other water courses within their jurisdiction.

## B. Discharges Not Covered

1. Stormwater discharges associated with industrial activity from any source other than construction activities described in Part I(A).

2. Post-construction discharges from industrial activity that originate from the site after construction activities have been completed at the site. Industrial and post-construction stormwater discharges may need to be covered by a separate stormwater permit.

3. The placement of fill into waters of the state requiring local, state, or federal authorizations (such as U.S. Army Corps of Engineers Section 404 permits).

4. This permit does not substitute for obligations under the National Environmental Policy Act (NEPA), Endangered Species Act (ESA), Wild and Scenic Rivers Act, or National Historic Preservation Act (NHPA), it is your responsibility to ensure the project and resulting discharges comply with the respective requirements.

5. Discharges to waters for which there is a total maximum daily load (TMDL) allocation for sediment and/or parameters associated with sediment transport are not covered unless you develop a Stormwater Pollution Prevention plan (SWPPP) that is consistent with the assumptions and requirements in the approved TMDL. To be eligible for coverage under this general permit, the SWPPP must incorporate the conditions applicable to the discharge necessary for consistency with the assumptions, allocations and requirements of the TMDL. If a specific numeric wasteload allocation has been established that would apply to discharges from construction activity, the permittee must incorporate that allocation into the SWPPP and implement necessary steps to meet that allocation. Information about TMDL allocations may be found at the following website: www.ndhealth.gov/WQ/SW/Z2_TMDL/default.htm.

6. Stormwater discharges that the department determines will cause, or have the reasonable potential to cause or contribute to a violation of the standards for quality for waters of the state (North Dakota Administrative Code (N.D.A.C.) 33-16-02.1).

7. Discharges from hydrostatic testing, well points, water line disinfection and treatment of gasoline or diesel contaminated groundwater.

8. Discharges of wash water using detergents, wastewater, or sanitary waste.

## C. Obtaining Coverage and Authorization Effective Date

1. To obtain authorization under this general permit for stormwater discharges you must submit a complete application and develop a SWPPP in accordance with Part II(C) of this permit. A SWPPP must be in place as a condition of the permit and a copy of the SWPPP must be retained by the permittee.

2. Permit coverage will become effective seven (7) days after you submit a complete application unless otherwise notified by the department (based on the department receipt date).

3. Upon the effective date of permit coverage you, as the permit applicant, are authorized to discharge stormwater from eligible activities under the terms and conditions of this permit.

## D. Application (Notice of Intent) Process

1. You must use a Notice of Intent (NOI) to complete your application. An NOI form (or a replacement application form) is available at the following website: www.ndhealth.gov/WQ/Storm/Construction/ConstructionHome.htm.

2. Application Content and Conditions.

   a. The owner, or owner jointly with the operator (usually the general contractor), shall submit a completed application for this permit. The owner is responsible for compliance with all terms and conditions of this permit. The operator has day to day supervision of construction activities and is jointly responsible with the owner for compliance with the permit conditions as they pertain to the construction activities delegated to the operator.

   b. The application (Notice of Intent) shall contain, at a minimum, the following information:

      (1) Owner name, mailing address and phone number;
      (2) Project contact name and phone number;
      (3) Project/site name;
      (4) Project/site location (street address; section, township, range; or latitude and longitude) and county;
      (5) A brief description of the construction activity;
      (6) The anticipated start date and the anticipated completion date for the project (if known);
      (7) The estimated total area of the site and the total area of disturbance in acres;
      (8) The name of receiving water(s), or the name of the municipal storm sewer system and receiving water(s);
      (9) The signature of the applicant(s), owner (and operator if co-applicants) signed in accordance with the signatory requirements in Part IV(A)(6) of this permit.

   c. A SWPPP (Part II(C)) for the project must be prepared and available for review, upon request, by the department at the time of application. A partially complete plan is acceptable when it clearly identifies the item(s) to be completed, the person(s) responsible for completing the item(s) and the deadline for completing the item(s). The SWPPP must be completed prior to the start of construction (or the applicable construction phase). You are not required to submit the SWPPP with the application unless otherwise notified by the department.

3. For residential construction activity occurring within a common plan of development (such as a subdivision) subject to the permit requirements, coverage may be obtained by the following:

   a. The owner of the lot(s) shall submit one (1) NOI for all of the owner's construction activity within the common plan of development, or

   b. The operator, such as a homebuilder who may represent one (1) or more lot owners, shall submit one (1) NOI for all of the operator's construction activity within each addition of the common plan of development.

      In addition, a SWPPP must be developed and implemented for the permittee's activities within the common plan of development. Additional phases of the common plan of development may be included under the initial application and permit coverage provided the SWPPP is amended to include the additional area or phases.

4. For oil and gas exploration, production, processing, treatment operations, or transmission facilities, which discharge contaminated stormwater, permit applications may be submitted for individual project sites or for an area of operations such as well field or by county.

5. Completed applications and any reports required by this permit shall be submitted to:

North Dakota Department of Health
Division of Water Quality
918 East Divide Avenue
Bismarck, ND 58501-1947

**E. Notice of Termination (NOT)**

1. Permittees wishing to terminate coverage under this permit must submit a Notice of Termination (NOT) or other written request identifying the facility, reason why the permit is no longer needed and signed in accordance with Part IV(A)(6) of this permit. Compliance with the conditions of this permit is required until a NOT is submitted to the department.

2. Permittees may only submit a NOT after one of the following conditions have been met:

   a. Final stabilization (Part II(E)) has been achieved on all portions of the site for which the permittee is responsible.

   b. Another owner/operator/permittee has assumed control, in accordance with the transfer provisions (Part I(F)), over all areas of the site that have not achieved final stabilization.

   c. For residential construction only, a NOT is not required for each lot that is sold, transferred, or has achieved final stabilization. The permittee must modify their SWPPP to indicate that permit coverage is no longer required for that lot. The SWPPP shall indicate the reason why coverage is no longer needed and the date the lot was sold, transferred, or achieved final stabilization. In order to terminate coverage, all lots under the control of the owner or operator must be sold, transferred, or achieved final stabilization (Part II(E)).

**F. Transfer of Ownership or Control**

1. When the owner or operator of a construction project changes, the new owner or operator must submit a written request for permit transfer/modification within fourteen (14) days of assuming control of the site or commencing work on-site, or of the legal transfer, sale or closing on the property; except as provided in Part I(F)(2). Late submittals will not be rejected; however the department reserves the right to take enforcement for any unpermitted discharges or permit noncompliance. For stormwater discharges from construction activities where the owner or operator changes, the new owner or operator can implement the original SWPPP created for the project or develop and implement their own SWPPP. Permittee(s) shall ensure either directly or through coordination with other operators that their SWPPP meets all terms and conditions of this permit and that their activities do not interfere with another party's erosion and sediment control practices.

2. A permit transfer/modification request is not required for the legal transfer, sale or closing on a property between permittees covered by this permit. Examples include the sale of a property parcel from a developer to a builder, or the transfer of an easement from a developer to a local government authority. If the new party is not covered by this permit at the time of transfer or sale, then the new owner/operator must submit a completed application/NOI within 14 days of assuming control of the site.

## II. STORMWATER DISCHARGE REQUIREMENTS

### A. Prohibition of Non-Stormwater Discharges

The discharge of wastewater is not authorized by this permit. The following sources of non-stormwater discharges are allowed if they are not a significant source of pollution and are identified in the SWPPP: fire-fighting, fire hydrant flushing, potable water line flushing, equipment wash down without detergents or hazardous cleaning products, uncontaminated foundation drains, springs, surface water, lawn watering, chemical treatment of stormwater and air conditioning condensate. Impervious surface wash water may not be directed into any surface water or storm drain inlet unless appropriate pollution prevention measures have been implemented. Discharges may not come into contact with oil and grease deposits or any other toxic or hazardous materials (unless cleaned up using dry clean-up methods). The SWPPP must include a description of the pollution prevention measures to be implemented while non-stormwater discharges are occurring.

If chemical treatment for sediment removal is intended to be used on-site, the permittee shall provide the department with the information outlined in Appendix 1(A)(14) of this permit for approval prior to use. This information shall be provided to the department no later than sixty (60) days prior to use.

### B. Releases in Excess of Reportable Quantities

This permit does not relieve the permittee of the reporting requirements of 40 CFR 110, 40 CFR 117, and 40 CFR 302, nor the reporting requirements found in Chapter 33-16-02.1 of the North Dakota Administrative Code. Any releases which meet any reporting requirement, must be reported to the agencies identified in Part IV(A)(7).

### C. Stormwater Pollution Prevention Plans

All permittees shall implement a SWPPP for any construction activity requiring this permit until final stabilization is achieved. The SWPPP and revisions are subject to review by the department. The objectives of the SWPPP is to identify potential sources of sediment and other sources of pollution associated with construction activity, and to ensure practices are implemented and maintained to reduce the contribution of pollutants in stormwater discharges from the construction site to waters of the state and storm sewer systems. Stormwater management documents developed under other regulatory programs may be included or incorporated by reference in the SWPPP, or used in whole as a SWPPP if it meets the requirements of this part.

The SWPPP may identify more than one permittee and may specify the responsibilities of each permittee by task, area, and/or timing. Permittees may coordinate and prepare more than one SWPPP to accomplish this. However, in the event there is a requirement under the SWPPP for which responsibility is ambiguous or is not included in the SWPPP, each permittee shall be responsible for implementation of that requirement. Each permittee is responsible for assuring that their activities do not render another permittee's controls ineffective.

The SWPPP must incorporate the requirements provided in Appendix 1 and shall include the following information.

1. **Site Description**. Each plan shall provide a description of the construction activity and potential sources of pollution as indicated below:

    a. A description of the overall project and the type of construction activity;

b. Estimates of the total area of the site and the total area that is expected to be disturbed by excavation, grading, grubbing, or other activities during the life of the project;

c. A proposed timetable/schedule, or chart, of activities that includes major phases/stages, BMP implementation, BMP removal, disturbances, and stabilization for major portions of the site;

d. A description of the soil within the disturbed area(s);

e. The name of the surface water(s) and municipal storm sewer system at or near the disturbed area that will receive stormwater runoff from the project site; and

f. A site map which indicates the following items as applicable (more than one (1) map may be needed). If an item is not applicable, provide rationale describing why the item is not applicable to the construction activity:

1) Project boundaries;
2) Areas of ground disturbance during each phase/stage of the project;
3) Areas where disturbance will not occur, such as avoidance areas (e.g. wetlands, critical habitat, Threatened and Endangered Species, etc);
4) Drainage patterns including: flow direction (run-on and runoff);
5) Dividing lines, discharge points, and storm sewer system inlets which the site drains to or may be affected by the activity;
6) Pre-existing and final grades;
7) Location of all temporary and permanent sediment and erosion controls during each particular phase;
8) Location of any stormwater conveyances such as: retention ponds, detention ponds, ditches, pipes, swales, stormwater diversions, culverts, and ditch blocks;
9) Location of potential sources of pollution (e.g. portable toilets, trash receptacles, etc.);
10) Location of soil stockpiles;
11) Identify steep slopes;
12) Surface waters, including an aerial extent of wetland acreage;
13) Location of surface water crossings;
14) Locations where stormwater is discharged to surface waters;
15) Location of dewatering discharge points;
16) Locations of where chemical treatment of stormwater will be performed, including discharge points;
17) Fueling locations, vehicle and equipment maintenance areas, designated wash water collection site, lubricant and chemical storage, paint storage, material storage, staging areas, and debris collection area;
18) Location of any impervious surfaces upon completion of construction; and
19) Where included as part of the project, the site maps for off-site concrete/asphalt batch plants, equipment staging areas, borrow sites or excavated fill material disposal sites. Site maps must show items 1 through 18 of this section.

g. Projects that discharge stormwater which flows to a water body listed as impaired under section 303(d) of the Federal Clean Water Act due to sediment, suspended solids or turbidity must identify the water body and impairment in the SWPPP. The Department's 303(d) list may be found at the following website under Integrated Reports: www.ndhealth.gov/WQ/SW/Z2_TMDL/Integrated_Reports/B_Integrated_Reports.htm.

h. For water bodies which have a TMDL, the SWPPP must describe and conform to the Waste Load Allocations (WLA) of the water body as per Part II(C)(4)(g) of this permit. Information about TMDL allocations may be found at the following website: www.ndhealth.gov/WQ/SW/Z2_TMDL/default.htm.

2. **Narrative.** The SWPPP must include a narrative description of the selected operational controls and sediment and erosion controls as outlined in Part II(C)(3), Part II(C)(4), and Appendix 1 of this permit. When applicable, a description of the requirements for any additional environmental regulations (federal) and local requirements related to the project, as it relates to waters of the state, must also be included or incorporated by reference (e.g. The Wild and Scenic Rivers Act, The National Historic Preservation Act, The Endangered Species Act, Fish and Wildlife Coordination Act, National Environmental Policy Act, Section 404 of the Clean Water Act, etc.).

   The narrative shall describe at a minimum:

   a. The installation, removal (if applicable), and maintenance requirements of selected Best Management Practices (BMPs) for each phase/stage of construction activity;
   b. The rationale for the selection of all BMPs (calculations should be included if appropriate);
   c. Whether selected BMPs are temporary or permanent;
   d. Any descriptions of infeasibility or explanations as required in Part II, Part III(A), and Appendix 1 of this permit.

3. **Operational Controls**. The SWPPP shall describe the BMPs used in day to day operations on the project site that reduce the contribution of pollutants in stormwater runoff.

   a. The SWPPP must identify a person knowledgeable and experienced in the application of erosion and sediment control BMPs who will oversee the implementation of the SWPPP, and the installation, inspection and maintenance of the erosion and sediment control BMPs before and during construction, until a NOT is filed or the permit is transferred. A knowledgeable and experienced person is someone who meets the requirements of Part II(C)(3)(e) of this permit.

      The owner shall develop a chain of responsibility with all operators on the site to ensure that the SWPPP will be implemented and stay in effect until the construction project is complete, the entire site has undergone final stabilization, and a NOT has been submitted to the department.

   b. The SWPPP must include a description of good housekeeping practices used to maintain a clean and orderly site. The SWPPP shall describe how litter, debris, chemicals and parts will be handled to minimize exposure to stormwater. The SWPPP also shall describe what measures will be used to reduce and remove sediment tracked off-site by vehicles or equipment. In addition, the SWPPP shall describe methods which will be used to reduce the generation of dust.

   c. The SWPPP shall describe preventative maintenance practices used to ensure the proper operation of erosion and sediment control devices (e.g., fiber rolls, erosion control blankets and silt fences) and equipment used or stored on site. The SWPPP shall describe proper inspection procedures for ensuring proper operation of erosion and sediment control devices.

   d. The SWPPP shall describe spill prevention and response procedures where potential spills can occur. Specific handling procedures, storage requirements, spill containment, cleanup procedures, and disposal must be identified. Storage structures for petroleum products and other chemicals shall have adequate leak and spill protection to prevent any spilled materials from entering waters of the state or storm sewer systems.

      The potential discharge of hazardous substances in stormwater discharges shall be minimized by including measures onsite, detailed in the SWPPP to prevent and respond to releases of hazardous substances. If a reportable quantity release occurs, the SWPPP shall be revised to prevent the reoccurrence of such a release.

e. The SWPP shall outline how employees and responsible parties shall be trained on the implementation of the SWPPP. Training must be provided at least annually, as new employees or responsible parties are hired or as necessary to ensure compliance with the SWPPP and the general permit. Employees and responsible parties include individuals who are responsible for design, installation, maintenance and repair of stormwater controls and conducting inspections.

    1) On-site personnel must understand the requirements of this permit as it pertains to their role in implementing the SWPPP. On-site personnel must know:

        a. The purpose of the SWPPP, requirements of the SWPPP, and how the SWPPP will be implemented;

        b. The location of all BMPs identified in the SWPPP; and

        c. Correct installation, function, maintenance and removal (if applicable) of BMPs identified in the SWPPP.

    2) Personnel responsible for performing site inspections must understand when inspections must be conducted (Part III(A)), what must be inspected (Part II(C)(7), how to record findings, when to initiate corrective actions, and properly document corrective actions.

    3) Maintenance personnel must understand when maintenance must be performed on BMPs in order to maintain properly functioning BMPs and what needs to be recorded for corrective actions/maintenance records in accordance with Part III(A)(5) of this permit.

f. The SWPPP must describe how concrete grindings and slurry will be managed. Wastewater from concrete washout, cleanout or washout from: stucco, paint, joint compound, and other building materials shall not be discharged to waters of the state, storm sewer systems or curb and gutter systems.

    1) Wash water must be collected in leak-proof containers or leak-proof pits. Containers or pits must be designed and maintained so that overflows cannot occur due to inadequate sizing, precipitation events, or snowmelt.

g. The SWPPP shall describe any dewatering activities planned at the site. Dewatering or basin draining (e.g., pumped discharges, trench/ditch cuts for drainage) related to the permitted activity must be managed with appropriate BMPs, such that the discharge does not adversely affect the receiving water. The following conditions apply to dewatering activities:

    1) Dewatering is limited to un-contaminated stormwater, surface water, and groundwater that may collect on-site and those sources identified in Part II(A), if they are not a significant source of pollution. A separate permit must be obtained to discharge water from other sources such as hydrostatic testing of pipes, tanks, or other similar vessels; disinfection of potable water lines; pump testing of water wells; and the treatment of gasoline or diesel contaminated groundwater or surface water.

    2) The permittee(s) must operate the discharge to minimize the release of sediment and provide adequate BMPs where necessary to minimize erosion due to the discharge. Discharges must not lead to the deposition of sediment within stormwater conveyance systems or surface waters. Discharges must not cause or potentially cause a visible plume within a surface water body.

3) When dewatering, utilize structures or BMPs which allow for draw down to occur from the surface of the water, unless infeasible. If infeasible, documentation must be provided in the SWPPP. In addition, you must describe what BMP(s) will be used in its place.

4) In addition to the inspection requirements in Part III, dewatering activities shall be inspected daily. The inspection must include the dewatering site, areas where BMPs are being implemented and the discharge location. A record shall be maintained to document the inspections of the dewatering operation and actions taken to correct any problems that may be identified.

   a. Records shall contain at a minimum:

      i. Date and time of the inspection,
      ii. Inspector name,
      iii. Approximate volume of water discharged,
      iv. Findings of the inspection, including recommendations and schedule for corrective actions;
      v. Corrective actions taken (including dates, times, and party completing maintenance activities); and
      vi. Documentation that the SWPPP has been amended when changes are made to the dewatering activity in response to inspections.

5) Local authorities may require specific BMPs for discharges affecting their storm sewer system.

4. **Erosion and Sediment Controls**. Erosion and sediment controls and stabilization requirements must be implemented for each major phase of site activity (e.g., clearing, grading, building, and landscaping phases). A description of the erosion and sediment controls and site stabilization methods must be provided in accordance with Part II(C)(2) of this permit. Erosion and sediment controls, and site stabilization must conform to the requirements provided in Appendix 1. The description and implementation of controls shall address the following minimum components:

   a. The selection of erosion and sediment controls, and site stabilization shall consider the following:

      1. The expected amount, frequency, intensity, and duration of precipitation events;

      2. The nature of stormwater run-on and runoff from the site as well as changes during, and as a result of, construction activity. This includes changes to impervious surfaces, slopes, seasonal changes, and drainage features on-site;

      3. Channelized flow, must be handled in order to minimize erosion at outlets and to minimize impacts to downstream receiving waters;

      4. Soil types (wind and water erodibility, and settling time); and

      5. Seasonal conditions.

   b. Sediment basins, or an appropriate combination of equivalent sediment controls such as smaller sediment basins and/or sediment traps, silt fences, fiber logs, vegetative buffer strips, berms, etc., are required for all down slope boundaries of the disturbance area and for those side slope boundaries as may be appropriate for site conditions.

c. Temporary or permanent erosion protection and stabilization (such as cover crop planting or mulching) must be initiated immediately, as described in Appendix 1(A), for all exposed soil areas where activities have been completed or temporarily ceased.

d. All control measures must be properly selected, installed and maintained in accordance with the manufacturer's specifications and good engineering practices. If periodic inspections or other information indicates a control has been used inappropriately or incorrectly, the permittee must replace or modify the control for site situations. Corrective actions must be made prior to the next anticipated rainfall event of within 24 hours of discovery (whichever comes first) or as soon as field conditions allow. Documentation must be provided in the maintenance records if field conditions do not allow access along with a plan of action for performing maintenance activities.

   The permittee may deviate from the manufacturer's specifications and erosion and sediment control requirements in Appendix 1 if they provide justification for the deviation and document the rationale for the deviation in the SWPPP. Any deviation must provide equivalent erosion and sediment control.

e. If sediment escapes from the site, off-site accumulations of sediment must be removed in a manner and frequency sufficient to minimize off-site impacts as outlined in Appendix 1(B). The SWPPP must be modified to prevent further sediment deposition off-site.

f. Stormwater controls are expected to withstand and function properly during precipitation events of up to the 2-year, 24-hour storm event. Visible erosion and/or off-site sediment deposition from such storm events should be minimal. The 2-year, 24-hour rainfall event in North Dakota ranges from about 1.9 inches in the west to 2.3 inches in the east.

g. For projects that discharge stormwater which flows to a water body for which there is a TMDL allocation for sediment and/or parameters associated with sediment transport, the SWPPP must be consistent with the assumptions, allocations, and requirements in the approved TMDL. If a TMDL specifies certain BMPs or controls to meet a WLA applicable to the project's discharges, the BMPs or controls must be incorporated into the SWPPP. Information about TMDL allocations may be found at the following website: www.ndhealth.gov/WQ/SW/Z2_TMDL/default.htm.

5. **Stormwater Management**. The SWPPP must identify permanent practices incorporated into the project to control pollutants in stormwater discharges occurring after construction operations have been completed.

   a. Identify stormwater ponds; flow reduction methods; infiltration of runoff on-site; sequential systems which combine several practices or other post-construction stormwater management features.

   b. Identify velocity / energy dissipation devices placed at discharge locations and appropriate erosion protection for outfall channels and ditches.

   c. Maintenance for on-site stormwater management features is the responsibility of the permittee until the NOT is submitted or the feature is accepted by the party responsible for long term maintenance.

   d. The design, installation and use of stormwater management features must comply with applicable local, state or federal requirements.

6. **Maintenance**. All erosion and sediment control measures and other protective measures identified in the SWPPP must be maintained in effective operating condition. The SWPPP must indicate, as appropriate, the maintenance or clean out interval for sediment controls. If site inspections, required in Part III of this permit, identify BMPs that are not operating effectively, maintenance shall be arranged and accomplished in accordance to Appendix 1 or as soon as practicable.

7. **Inspections**. The SWPPP must provide for site inspections as outlined in Part III. The permittee shall ensure that personnel conducting site inspections are familiar with permit conditions and the proper installation and operation of control measures. Inspectors must be knowledgeable in their role of the SWPPP, as outlined in Part II(C)(3)(e) of this permit. The erosion and sediment control measures and stabilized areas identified in the SWPPP shall be observed to ensure they are operating correctly and in serviceable condition. Inspections shall include areas used for storage of materials, permanent stormwater control measures and vehicle maintenance areas. These areas shall be inspected for evidence of, or the potential for, pollutants entering a drainage system. If necessary, the plan shall be revised based on the observations and deficiencies noted during the inspection.

8. **SWPPP Review and Revisions**.

    a. The SWPPP shall be signed in accordance with the Signatory Requirements, Part IV(A)(6), and retained on-site for the duration of activity as outlined in Part III(B).

    b. The permittee shall make the SWPPP available upon request to the department, EPA, or, in the case of discharges to a municipal storm sewer system, the operator of the municipal system.

    c. The permittee shall amend the SWPPP whenever there is a change in design, construction, operation, maintenance, or BMPs. The SWPPP shall be amended if the plan is found to be ineffective in controlling pollutants present in stormwater. The SWPPP shall be amended as soon as practicable.

## D. Local Requirements

All stormwater discharges must comply with the requirements, policies, or guidelines of municipalities and other local agencies as applicable to the construction site. Any discharges to a storm sewer, ditch or other water course under the jurisdiction of a municipality must comply with any specific conditions or BMPs required by the municipality or agency.

## E. Final Stabilization

The permittee(s) must ensure final stabilization of the site. The permittee(s) should submit a NOT within 30 days after final stabilization has been achieved, or another owner/operator (permittee) has assumed control according to Part I(F) for all areas of the site that have not undergone final stabilization. Final stabilization can be achieved in one of the following ways.

1. All soil disturbing activities at the site have been completed and all soils must be stabilized by a uniform perennial vegetative cover with a density of 70 percent of the pre-existing cover over the entire pervious surface area, or other equivalent means necessary to prevent soil failure under erosive conditions and;

    a. All drainage ditches, constructed to drain water from the site after construction is complete, must be stabilized to preclude erosion;

b. All temporary erosion prevention and sediment control BMPs (such as silt fence) must be removed as part of the site final stabilization; and

c. The permittee(s) must remove all sediment from conveyances and temporary sedimentation basins that will be used as permanent water quality management basins. Sediment must be stabilized to prevent it from being washed into basins, conveyances or drainage ways discharging off-site or to surface waters. The cleanout of permanent basins must be sufficient to return the basin to design capacity.

2. For areas of the state where the average annual rainfall is less than 20 inches, all soil disturbing activities at the site have been completed and erosion control measures (e.g., degradable rolled erosion control product) and stabilization methods are selected, designed, and installed along with an appropriate seed base to provide erosion control for at least three years and achieve 70 percent of the pre-existing vegetative cover within three (3) years without active maintenance. Sites must meet the criteria outlined in items 1(a), (b), and (c) above.

3. Disturbed areas on land used for agricultural purposes that are restored to their pre-construction agricultural use are not subject to these final stabilization criteria. If the construction activity removed standing crop, the area must be restored in accordance with the landowner.

   Areas disturbed that were not previously used for agricultural activities, such as buffer strips immediately adjacent to waters of the state, and areas which are not being returned to their pre-disturbance use must meet the final stabilization criteria in (1) or (2) above.

4. For residential construction only, final stabilization may be achieved when soil is stabilized (see Appendix 1(A)(3)) and down gradient perimeter control for individual lots has been implemented and the residence has been transferred to the homeowner. Additionally, the permittee must distribute a “homeowner fact sheet” to the homeowner to inform the homeowner of the need for, and benefits of, final stabilization. The permittee also must demonstrate that the homeowner received the fact sheet.

## III. SELF MONITORING AND REPORTING

### A. Inspection and Maintenance Requirements

1. Inspections shall be performed by or under the direction of the permittee at least once every 14 calendar days and within 24 hours after any storm event of greater than 0.25 inches of rain per 24-hour period. Inspections are only required during normal working hours. The permittee shall use a rain gauge on-site or utilize the nearest National Weather Service precipitation gauge station. Rain gauge locations or stations must be representative of the site.

   a. “Within 24 hours after any storm event greater than 0.25 inches rain per 24-hour period” means that you are required to conduct an inspection within 24 hours once a storm event has produced 0.25 inches, even if the storm event is still continuing. If there is a storm event at your site that continues for multiple days, and each day of the storm produces 0.25 inches or more rain, you are required to conduct an inspection within 24 hours of the first day of the storm and within 24 hours after the end of the storm.

2. There may be times when a site inspection may not be practical at the specified time. Adverse climatic conditions, such as flooding, high winds, tornadoes, electrical storms, site access constraints, etc., may prohibit inspections. The permittee must include a description of why the inspection(s) could not be performed at the designated time in the next inspection record. If an inspection is delayed due to adverse weather conditions or rain events outside normal working hours, an inspection must be conducted during the next working day, or as conditions allow.

3. Some erosion and sediment control measures may require more frequent inspection based on location (e.g., sensitive areas or waters of the state) or as a result of recurring maintenance issues. Erosion or sediment control measures found in need of maintenance between inspections must be repaired or supplemented with appropriate measures as soon as practicable. Erosion and sediment control measures which require more frequent inspection based on location or as a result of recurring maintenance issues must be identified in the SWPPP.

4. All inspections conducted during construction must be recorded in writing and these records must be retained in accordance with Part III(B). Records of each inspection activity shall include:

    a. Date and time of inspections;

    b. Name of person(s) conducting inspections;

    c. Findings of inspections, including recommendations and schedule for corrective actions;

    d. Date and amount of all rainfall events greater than 1/4 inch (0.25 inches) in 24 hours; and

    e. Documentation that the SWPPP has been amended when changes are made to BMPs in response to inspections.

    f. All inspection reports shall be signed in accordance with Part IV(A)(6) of this permit.

5. Corrective actions (maintenance activities) performed during construction must be recorded in writing and these records must be retained in accordance with Part III(B). Records for maintenance activity shall include:

    a. Best Management Practice corrected;

    b. Date and time of corrective action;

    c. Name of person(s) performing corrective actions;

    d. Corrective actions taken; and

    e. Corrective actions/maintenance records shall be signed in accordance with Part IV(A)(6) of this permit.

6. Completed areas that have been stabilized but do not meet the 70 percent perennial vegetative cover criteria for final stabilization may be inspected once per month. Inspections may be suspended for parts of the construction site that meet final stabilization requirements of Part II(E) of this permit. The SWPPP must update to identify any areas which meet this condition.

7. Inspections may be suspended where earthwork has been suspended due to frozen ground conditions. The required inspections and maintenance must resume as soon as runoff occurs or the ground begins to thaw at the site. The permittee must record freeze/thaw and runoff dates as part of the inspection records.

## B. Records Location

A copy of the completed and signed NOI, coverage letter from the department, SWPPP, site inspection records, and this general permit shall be kept at the site of the construction activity in a field office, trailer, shed, or in a vehicle that is on-site during normal working hours. If the site does not have a reasonable on-site location, then the documents must be retained at a readily available alternative location; preferably with the individual responsible for overseeing the implementation of the SWPPP. Electronic copies of records are acceptable if the records can be accessed on-site. If the site is inactive, then the documents may be stored at a local office. Permittees should avoid using personal electronic devices for storing electronic records.

## IV. STANDARD CONDITIONS

### A. COMPLIANCE RESPONSIBILITIES BP 2014.12.08

**1. Duty to Comply**
The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application.

**2. Proper Operation and Maintenance**
The permittee shall at all times maintain in good working order and operate as efficiently as possible all treatment or control facilities or systems installed or used by the permittee to achieve compliance with the terms and conditions of this permit. If necessary to achieve compliance with the conditions of this permit, this shall include the operation and maintenance of backup or auxiliary systems.

**3. Planned Changes**
The department shall be given advance notice of any planned changes at the permitted facility or of an activity which may result in permit noncompliance. Any anticipated facility expansions, production increase, or process modifications which might result in new, different, or increased discharges of pollutants shall be reported to the department as soon as possible. Changes which may result in a facility being designated a "new source" as determined in 40 CFR 122.29(b) shall also be reported.

**4. Duty to Provide Information**
The permittee shall furnish to the department, within a reasonable time, any information which the department may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The permittee shall also furnish to the department, upon request, copies of records required to be kept by this permit. When a permittee becomes aware that it failed to submit any relevant facts or submitted incorrect information in a permit application or any report, it shall promptly submit such facts or information.

**5. Records Retention**
All records and information (including calibration and maintenance) required by this permit shall be kept for at least three years or longer if requested by the department or EPA.

**6. Signatory Requirements**
All applications, reports, or information submitted to the department shall be signed and certified.

All permit applications shall be signed by a responsible corporate officer, a general partner, or a principal executive officer or ranking elected official.

All reports required by the permit and other information requested by the department shall be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:

a. The authorization is made in writing by a person described above and submitted to the department; and

b. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility, such as the position of plant manager, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters.

If an authorization under 6. Signatory Requirements is no longer accurate for any reason, a new authorization satisfying the above requirements must be submitted to the department prior to or together with any reports, information, or applications to be signed by an authorized representative.

Any person signing a document under this section shall make the following certification:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

**7. Twenty-four Hour Notice of Noncompliance Reporting**

1. The permittee shall report any noncompliance which may endanger health or the environment. Any information shall be provided orally as soon as possible, but no later than twenty-four (24) hours from the time the permittee first became aware of the circumstances. The following occurrences of noncompliance shall be included in the oral report to the department at 701.328.5210:

    a. Any lagoon cell overflow or any unanticipated bypass which exceeds any effluent limitation in the permit under 8. Bypass of Treatment Facilities;

    b. Any upset which exceeds any effluent limitation in the permit under 9. Upset Conditions; or

    c. Violation of any daily maximum effluent or instantaneous discharge limitation for any of the pollutants listed in the permit.

2. A written submission shall also be provided within five days of the time that the permittee became aware of the circumstances. The written submission shall contain:

    a. A description of the noncompliance and its cause;

    b. The period of noncompliance, including exact dates and times;

    c. The estimated time noncompliance is expected to continue if it has not been corrected; and

    d. Steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance.

    Reports shall be submitted to the address in **Part I(D) Application (Notice of Intent) Process**. The department may waive the written report on a case by case basis if the oral report has been received within 24 hours by the department at 701.328.5210 as identified above.

    All other instances of noncompliance shall be reported no later than at the time of the next Discharge Monitoring Report submittal. The report shall include the four items listed in this subsection.

**8. Bypass of Treatment Facilities**

1. Bypass not exceeding limitations. The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to assure efficient operation. These bypasses are not subject to any of the following provisions in this section.

Bypass exceeding limitations-notification requirements.

a. Anticipated Bypass. If the permittee knows in advance of the need for a bypass, it shall submit prior notice, if possible at least ten (10) days before the date of bypass.

b. Unanticipated Bypass. The permittee shall submit notice of an unanticipated bypass as required under 7. Twenty-four Hour Notice of Noncompliance Reporting.

2. Prohibition of Bypass. Bypass is prohibited, and the department may take enforcement action against a permittee for bypass, unless:

a. Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;

b. There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and

c. The permittee submitted notices as required under the 8(a). Anticipated Bypass subsection of this section.

The department may approve an anticipated bypass, after considering its adverse effects, if the department determines that it will meet the three (3) conditions listed above.

**9. Upset Conditions**

An upset constitutes an affirmative defense to an action brought for noncompliance with erosion and sediment or site stabilization methods if the requirements of the following paragraph are met. No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.

A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

1. An upset occurred and the permittee can identify its cause(s);

2. The permitted facility was, at the time being, properly operated;

3. The permittee submitted notice of the upset as required under 7. Twenty-four Hour Notice of Noncompliance Reporting and

4. The permittee complied with any remedial measures required under 10. Duty to Mitigate.

In any enforcement proceeding, the permittee seeking to establish the occurrence of an upset has the burden of proof.

**10. Duty to Mitigate**

The permittee shall take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment. The permittee, at the department's request, shall provide accelerated or additional monitoring as necessary to determine the nature and impact of any discharge.

**11. Removed Materials**

Collected screenings, grit, solids, sludges, or other pollutants removed in the course of treatment shall be buried or disposed of in such a manner to prevent any pollutant from entering any waters of the state or creating a health hazard.

**12. Duty to Reapply**

Any request to have this permit renewed should be made 15 days prior to its expiration date.

## B. GENERAL REQUIREMENTS

**1. Inspection and Entry**

The permittee shall allow department and EPA representatives, at reasonable times and upon the presentation of credentials if requested, to enter the permittee's premises to inspect the construction activity and monitoring equipment, to sample any discharges, and to have access to and copy any records required to be kept by this permit.

**2. Availability of Reports**

Except for data determined to be confidential under 40 CFR Part 2, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the department and EPA. As required by the Act, permit applications, permits, and effluent data shall not be considered confidential.

**3. Transfers**

This permit is not transferable except upon the filing of a Transfer/Modification request (Part I(F)) by the new party. The current permit holder should inform the new controller, operator, or owner of the existence of this permit and also notify the Department of the possible change.

**4. New Limitations or Prohibitions**

The permittee shall comply with any effluent standards or prohibitions established under Section 306(a), Section 307(a), or Section 405 of the Act for any pollutant (toxic or conventional) present in the discharge or removed substances within the time identified in the regulations even if the permit has not yet been modified to incorporate the requirements.

**5. Permit Actions**

This permit may be modified, revoked and reissued, or terminated for cause. This includes the establishment of limitations or prohibitions based on changes to Water Quality Standards, the development and approval of waste load allocation plans, the development or revision to water quality management plans, or the establishment of prohibitions or more stringent limitations for toxic or conventional pollutants and/or sewage sludges. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not stay any permit condition.

**6. Need to Halt or Reduce Activity Not a Defense**

It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

**7. State Laws**

Nothing in this permit shall be construed to preclude the institution of legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable state law or regulation preserved under Section 510 of the Act.

**8. Oil and Hazardous Substance Liability**

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under Section 311 of the Act.

**9. Property Rights**

The issuance of this permit does not convey any property rights of any sort, nor any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of federal, state or local laws or regulations.

**10. Severability**

The provisions of this permit are severable, and if any provision of this permit or the application of any provision of this permit to any circumstance is held invalid, the application of such provision to other circumstances and the remainder of this permit shall not be affected thereby.

## V. DEFINITIONS Permit Specific BP 2009.02.05

"303(d) List" or "Section 303(d) List" means a list of North Dakota's water quality-limited waters needing total maximum daily loads or TMDLs developed to comply with section 303(d) of the Clean Water Act. A copy of the latest integrated report is available on the state's web site at: www.ndhealth.gov/WQ/SW/Z2_TMDL/Integrated_Reports/B_Integrated_Reports.htm.

"Act" means the Clean Water Act.

"Bankfull" means the channel is filled to the top of one or both of its banks.

"BMP" or "Best Management Practices" means schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters of the state. BMPs also include treatment requirements, operating procedures and practices to control construction site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

"Bypass" means the intentional diversion of waste streams from any portion of a treatment facility.

"Common Plan of Development or Sale" means a contiguous area where multiple separate and distinct land disturbing activities may be taking place at different times, on different schedules, but under one proposed plan. One plan is broadly defined to include design, permit application, advertisement or physical demarcation indicating that land-disturbing activities may occur.

"Construction Activity" means construction activity as defined in 40 CFR part 122.26(b)(14)(x) and small construction activity as defined in 40 CFR part 122.26(b)(15). This includes a disturbance to the land that results in a change in topography, existing soil cover (both vegetative and non-vegetative), or the existing soil topography that may result in accelerated stormwater runoff, leading to soil erosion and movement of sediment into surface waters or drainage systems. Examples of construction activity may include clearing, grading, filling and excavating. Construction activity includes the disturbance of less than one acre of total land area that is part of a larger common plan of development or sale if the larger common plan will ultimately disturb one (1) acre or more. Construction activity does not include routine maintenance that is performed to maintain the original line and grade, hydraulic capacity, or original purpose of the facility.

"Department" means the North Dakota Department of Health, Division of Water Quality.

"Energy Dissipation" means methods employed at pipe outlets to prevent erosion. Examples include, but are not limited to: concrete aprons, riprap, splash pads, and gabions that are designed to prevent erosion.

"Indian Country" means (1) All land within the limits of any Indian reservation under the jurisdiction of the United States Government, notwithstanding the issuance of any patent, and including rights-of-way running through the reservations; (2) All dependent Indian communities within the borders of the United States whether within the originally or subsequently acquired territory thereof, and whether within or without the limits of a state; and (3) All Indian allotments, the Indian titles to which have not been extinguished, including rights-of-way running through the same.

"Infeasible" means not technologically possible or not economically practicable and achievable in light of best industry practices.

"Immediately" means as soon as practicable, but no later than the end of the next work day, following the day when the earth-disturbing activities have temporarily or permanently ceased.

“Large Construction Activity” means land disturbance of equal to or greater than five (5) acres. Large construction activity also includes the disturbance of less than one acre of total land area that is part of a larger common plan of development or sale, if the larger common plan will ultimately disturb equal to or greater that five acres.

“Normal Wetted Perimeter” means the area of a conveyance, such as a ditch, channel, or pipe that is in contact with water during flow events that are expected to occur once every year.

“Non-Stormwater Discharges” means discharges other than stormwater. The term includes both process and non-process sources. Process wastewater sources that require a separate NDPDES permit include, but are not limited to industrial processes, domestic facilities and cooling water. Non-stormwater sources that may be addressed in this permit include, but are not limited to: fire-fighting, fire hydrant flushing, potable water line flushing, equipment wash down without detergents or hazardous cleaning products, uncontaminated foundation drains, springs, surface water, lawn watering, chemical treatment of stormwater and air conditioning condensate.

“Operator” means the person (usually the general contractor) designated by the owner who has day to day operational control and/or the ability to modify project plans and specifications related to the SWPPP. The person must be knowledgeable in those areas of the permit for which the operator is responsible and must perform those responsibilities in a workmanlike manner.

“Owner” means the person or party possessing the title of the land on which the construction activities will occur; or if the construction activity is for a lease holder, the party or individual identified as the lease holder; or the contracting government agency responsible for the construction activity.

“Permanently Ceased” means clearing and excavation within any area of your construction site that will not include permanent structures has been completed.

“Permanent Cover” means final stabilization. Examples include grass, gravel, asphalt, and concrete.

"Severe Property Damage" means substantial physical damage to property, damage to best management practices which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in construction.

"Significant Materials" includes, but is not limited to: raw materials; fuels; materials such as solvents, detergents, and plastic pellets; finished materials such as metallic products; hazardous substances designated under Section 101(14) of CERCLA; any chemical the facility is required to report pursuant to Section 313 of Title III of SARA; fertilizers; pesticides; and waste products such as ashes, slag and sludge that have the potential to be released with stormwater discharges.

"Significant Spills" includes, but is not limited to: releases of oil or hazardous substances in excess of reportable quantities under Section 311 of the Clean Water Act (see 40 CFR 110.10 and CFR 117.21) or Section 102 of CERCLA (see 40 CFR 302.4).

“Small Construction Activity” means land disturbance of equal to or greater than one acre and less than five acres. Small construction activity also includes the disturbance of less than one acre of total land area that is part of a larger common plan of development or sale, if the larger common plan will ultimately disturb equal to or greater than one and less than five acres

"Stabilized" means the exposed ground surface has been covered by appropriate materials such as mulch, staked sod, riprap, erosion control blanket, or other material that prevents erosion from occurring. Grass seeding alone is not stabilization. Snow cover and frozen ground conditions are not considered stabilized.

“Steep Slopes” means slopes which are fifteen (15) percent or greater in grade.

"Stormwater" means stormwater runoff, snow melt runoff, and surface runoff and drainage.

“Stormwater Associated with Industrial Activity” means stormwater runoff, snow melt runoff, or surface runoff and drainage from industrial activities as defined in 40 CFR 122.26(b)(14).

“Stormwater Associated with Small Construction Activity” means the discharge of stormwater from:

(i) Construction activities including clearing, grading, and excavating that result in land disturbance of equal to or greater than once acre and less than five acres. Small construction activity also includes the disturbance of less than one acre of total land area that is part of a larger common plan of development or sale if the larger common plan will ultimately disturb equal to or greater than one and less than five acres. Small construction activity does not include routine maintenance that is performed to maintain the original line and grade, hydraulic capacity, or original purpose of the facility.

(ii) Any other construction activity designated by EPA or the department, based on the potential for contribution to a violation of a water quality standard or for significant contribution of pollutants to waters of the state.

“Temporarily Ceased” means clearing, grading, and excavation within any area of the site that will not include permanent structures, will not resume (i.e., the land will be idle) for a period of 14 or more calendar days, but such activities will resume in the future.

"Temporary Erosion Protection" means methods employed to prevent erosion. Examples of temporary cover include; mulch, straw, erosion control blanket, wood chips, tackifiers, and erosion netting.

"Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with permit requirements because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed erosion and sediment controls or site stabilization methods, inadequate erosion and sediment controls or site stabilization methods, lack of preventive maintenance, or careless or improper operation.

“Waters of the State” means any and all surface waters that are contained in or flow in or through the state of North Dakota as defined in NDCC 61-28-02. This definition includes all water courses, even if they are usually dry.

“You” means the owner, operator or permittee as appropriate.

**Appendix 1 – Erosion and Sediment Control Requirements**

Requirements for designing, implementing and maintaining erosion and sediment controls.

## A. Erosion and Sediment Control Practices

1. Sites using temporary (or permanent) sediment basins must meet the following requirements:

    a. Sediment basins shall be designed for a calculated volume of runoff from a 2-year, 24-hour storm per acre drained to the basin and provides not less than 1,800 cubic feet of sediment storage below the invert of the outlet pipe from each acre drained to the basin; or

    b. Basins shall be sized to provide 3,600 cubic feet of sediment storage below the invert of the outlet pipe per acre drained to the basin if calculations are not performed.

    c. Basin outlets must be designed to avoid short-circuiting and the discharge of floating debris. Basins must be designed with the ability to allow complete basin drawdown for maintenance activities. Basins must release the storage volume in at least 24 hours. Outlet structures must be designed to withdraw water from the surface, unless not practicable. If not practicable, rationale must be provided in the SWPPP. The basin must have a stabilized emergency overflow to prevent failure of pond integrity. Energy dissipation must be provided for the basin outlet.

2. Erosion, sediment, and stabilization practices shall be provided. Erosion, sediment and stabilization practices include such things as: silt fences, fiber logs, vegetative buffer strips, erosion control blankets, mulch, hydro-seeding combined with mulch or tackifiers, etc.

3. All exposed soil areas must be stabilized (see definitions). Stabilization must be initiated immediately where activities have been permanently or temporarily ceased on any portion of the site and will not resume for a period exceeding fourteen (14) calendar days. Stabilization must be completed as soon as practicable, but no later than fourteen (14) calendar days after the initiation of soil stabilization. Temporary stockpiles without significant silt, clay or organic components (e.g., clean aggregate stockpiles, demolition concrete stockpiles, sand stockpiles) are exempt from this requirement.

    a. For slopes with a grade of 3:1 or greater, stabilization must be initiated immediately once activities have been completed or temporarily ceased. Stabilization must be completed as soon as practicable, but no later than seven (7) calendar days after the initiation of soil stabilization.

4. Temporary soil stockpiles must have effective sediment controls, and cannot be placed in surface waters, including stormwater conveyances such as curb and gutter systems, or conduits and ditches.

5. The normal wetted perimeter of any temporary or permanent drainage ditch that drains water from a construction site, or diverts water around a site, must be stabilized at least 200 linear feet from the property edge, or from the point of discharge to any surface water. Stabilization shall be completed prior to connection with a surface water. Any remaining portion of the temporary or permanent drainage ditch must be stabilized within fourteen (14) calendar days for portions which construction activities have temporarily or permanently ceased.

6. If stabilization requirements cannot be met due to circumstances beyond the control of the permittee, the permittee may comply with following:

    a. If vegetative stabilization is to be used, immediately initiate, and within 14 calendars days complete, the installation of temporary non-vegetated stabilization; or

    b. Complete all methods of initiating stabilization as soon as conditions or circumstances allow.

If any conditions in parts a or b above are encountered, the permittee must document the circumstances which prevented you from meeting the stabilization requirements in the SWPPP of this paragraph and provide a schedule in the SWPPP which will be followed in order to meet the stabilization requirements.

Permittees are responsible for implementing winter stabilization methods during frozen ground conditions if the site was not stabilized prior to the ground freezing.

7. Stream diversions or any temporary or permanent drainage ditch or trench, which will have continuous flow, shall be stabilized with appropriate controls prior to connection with any surface water. The entire area (channel and bank) of the stream diversion or temporary or permanent drainage ditch, or trench, must be appropriately stabilized to bankfull height.

8. While working in or around surface waters, sediment and erosion controls must be used above the anticipated level of the surface water. Floating silt curtain does not satisfy the down slope and side slope boundary requirements in Part II(C)(4)(b) of this permit, unless the construction activity is on or below the elevation of the surface water. The floating silt curtain must be placed as close to shore as possible. Sediment control must be installed where exposed soils drain to the surface water immediately after construction activity along the waterline has been completed.

9. Pipe and culvert outlets must be provided with energy dissipation within 24 hours of connection to a surface water.

10. Splash pads and/or downspout extensions must be provided for roof drains to prevent erosion from roof runoff.

11. All storm drain inlets in the immediate vicinity of the construction site must be protected by appropriate BMPs during construction until all disturbed areas and stockpiles with the potential to discharge to the inlet have been stabilized. This includes storm drain inlets which may be affected by sediment tracked onto paved surfaces by vehicles or equipment.

12. Inlet protection devices are a last line of control – erosion and sediment control practices must be used on-site. Inlet protection devices must conform to local ordinances or regulations. In general, inlet protection devices need to provide for adequate drainage to prevent excessive roadway flooding. Inlet protection may be removed for a particular inlet if a specific concern (i.e., street flooding/freezing, snow removal) has been identified and documented in the SWPPP. In this situation, additional erosion and sediment control practices, or stabilization methods must be used to supplement the loss of the inlet protection device to prevent sediment from entering the storm sewer system.

13. Vegetated buffers must have a minimum width of 1 foot for every 5 feet of disturbed area that drains to the buffer. The width of the buffer shall have a slope of 5 percent or less and the area draining to the buffer shall have a slope of 6 percent or less. Concentrated flows should be minimized throughout the buffer.

    Buffers shall consist of dense grassy vegetation, 3 to 12 inches tall with uniform coverage over 90 percent of the buffer. Woody vegetation shall not be counted for the 90 percent coverage. No more than 10 percent of the overall buffer may be comprised of woody vegetation.

14. A 50 foot natural buffer or equivalent erosion and sediment controls must be provided when a project is within 50 feet of a surface water and stormwater flows to the surface water. If equivalent erosion and sediment controls are used, rationale for using equivalent controls must be provided in the SWPPP.

If working within 100 feet of a surface water listed as impaired for sediment, suspended solids or turbidity, a 100 foot natural buffer or equivalent sediment and erosion controls must be provided. If equivalent erosion and sediment controls are to be used, rationale for using equivalent controls must be provided in the SWPPP.

15. If the permittee(s) intend to use chemical treatment for sediment removal, they must be used in accordance with the manufacturer's specifications. Treatment chemicals must be selected appropriately for the anticipated soil particle size and characteristics of the stormwater (pH, turbidity, flow rate of stormwater flowing into the chemical treatment system, etc.). A description of the chemical treatment process must be included in the SWPPP.

    a. To ensure selection and management of chemicals minimize the potential for harmful effects in the discharge, the permittee shall provide a written request to the department for review and approval. Additional monitoring and reporting may be required as a condition for the approval to discharge.

       A request to discharge chemically treated water shall include all of the following information and be provided sixty (60) days prior to use:

       i. Material Safety Data Sheet/Safety Data Sheet (MSDS/SDS);
       ii. Proposed water additive discharge concentration;
       iii. Discharge frequency (i.e., number of hours per day and number of days per year);
       iv. Monitoring point for product discharge;
       v. Type of removal treatment, if any, that the water additive receives prior to discharge;
       vi. Product function (e.g., coagulant, flocculant, etc.);
       vii. A 48-hour $LC_{50}$ or $EC_{50}$ for a North American freshwater planktonic crustacean (*Ceriodaphnia* sp., *Daphnia* sp., or *Simocephalus* sp.); and
       viii. Results for a toxicity test for one other North American freshwater aquatic species (other than a planktonic crustacean).

    b. Discharges from the chemical treatment of stormwater must not cause a violation of the standards of quality for waters of the state (N.D.A.C. § 33-16-02.1). The discharge must meet the dewatering or basin draining requirements provided in Part II(C)(3)(g) of this permit.

16. Minimize the duration of exposed soils on steep slopes.

**B. Maintenance Requirements for Erosion and Sediment Controls**

1. All erosion prevention and sediment control BMPs must be inspected to ensure integrity and effectiveness. All nonfunctional BMPs must be repaired, replaced, maintained or supplemented with functional BMPs. If a nonfunctioning BMP is supplemented, the nonfunctional BMP shall be removed. Corrective actions must be made prior to the next anticipated rainfall event or within 24 hours of discovery (whichever comes first), or as soon as field conditions allow access. Documentation must be provided in the maintenance records if field conditions do not allow access along with a plan of action for performing maintenance activities.

   Permittee(s) must investigate and comply with the following inspection and maintenance requirements:

   a. All control devices similar to, and including, silt fence or fiber rolls must be repaired, replaced, maintained or supplemented when they become nonfunctional (torn from posts, visible tears, etc.). Collected sediment must be removed as it approaches 1/2 of the above ground capacity of the control device.

   b. Fiber rolls must be replaced when 1/2 of the original above ground height of the device when it was installed has been lost as a result of flattening or other damage.

c. Sedimentation basins must be drained and the sediment removed when the depth of sediment collected in the basin reaches 1/2 the storage volume. Drainage and removal must be completed within 72 hours of discovery, or as soon as field conditions allow access. Documentation must be provided in the maintenance records if field conditions do not allow access along with a plan of action for performing maintenance activities.

d. Maintenance and cleaning of inlet protection devices must be performed when sediment accumulates, the filter becomes clogged, and/or performance is compromised.

2. Surface waters, including drainage ditches and conveyance systems, must be inspected for evidence of sediment deposited by erosion. Permittees must remove all deltas and sediment deposits in surface waters, drainage ways, catch basins, and other drainage systems. Areas where sediment removal results in exposed soil must be stabilized. Removal and stabilization must take place immediately, but no more than, seven (7) calendar days after the discovery unless precluded by legal, regulatory or physical access constraints. Permittees shall use all reasonable efforts to obtain access. If precluded, removal and stabilization shall take place immediately, but no more than, seven (7) calendar days after obtaining access. Permittees are responsible for contacting all local, regional, state, and federal authorities, and receiving any applicable permits prior to conducting any work.

3. Vehicle tracking of sediment from the site must be minimized by BMPs. This may include having a designated egress with aggregate surfacing from the site or by designating off-site parking. Permittees are responsible for (or making the arrangements for) street sweeping and/or scraping if BMPs are not adequate to prevent sediment from being tracked onto the street from the site.

   Construction site egress locations must be inspected for evidence of sediment being tracked offsite by vehicles or equipment onto paved surfaces. Accumulations of tracked and deposited sediment must be removed from all off-site paved surfaces by the end of the work day, shift or if applicable, within a shorter time specified by local authorities or the department.

4. If sediment escapes the construction site, off-site accumulations of sediment must be removed in a manner and at a frequency sufficient to minimize off-site impacts (e.g., fugitive sediment in streets could be washed into storm sewers by the next rain event and/or pose a safety hazard to users of public streets).

5. Vegetative buffers must be inspected for proper distribution of flows, sediment accumulation and signs of rill formation. If a buffer becomes silt covered, contains rills, or is otherwise rendered ineffective, other control measures shall be implemented. Eroded areas shall be repaired and stabilized within 24 hours of discovery, or as soon as conditions allow access. Documentation must be provided in the maintenance records if field conditions do not allow access along with a plan of action for performing maintenance activities.

**C**. **Operational Controls**

1. Properly handle construction debris and waste materials.

   a. Debris and waste must be handled appropriately until disposal. Litter and debris shall be collected and stored to reduce the potential for wind and water to carry the materials off-site or leachate discharging from a site. Collected material shall be taken to the appropriate facility for disposal or recycling.

   b. Liquid or soluble materials including oil, fuel, paint and any other hazardous substances must be properly stored, to prevent spills, leaks or other discharges. Restricted access to storage areas must be provided to prevent vandalism. Storage and disposal of liquid or soluble material must be in compliance with applicable regulations.

2. Wash water containments must be cleaned out (solids and liquid) before 80 percent of storage capacity is attained.

3. Best management practices used in surface waters must be cleaned immediately upon removal from surface waters to prevent the transfer of aquatic nuisance species.

# NOTICE OF COVERAGE LETTER

**COPY OF NOTICE OF COVERAGE LETTER TO BE INSERTED**

# DELEGATION OF AUTHORITY LETTER

**COPY OF DELEGATION OF AUTHORITY LETTER TO BE INSERTED**

# SWPPP AMENDMENT / REVISION LOG

## SWPPP AMENDMENT / REVISIOM LOG

| Date of Update / Amendment | General Description of Amendment | Page Numbers or Section(s) where Changes Made | Name of Author |
|---|---|---|---|
| 3/4/2020 | | N/A | SWCA Environmental Consultants |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

# APPENDIX B

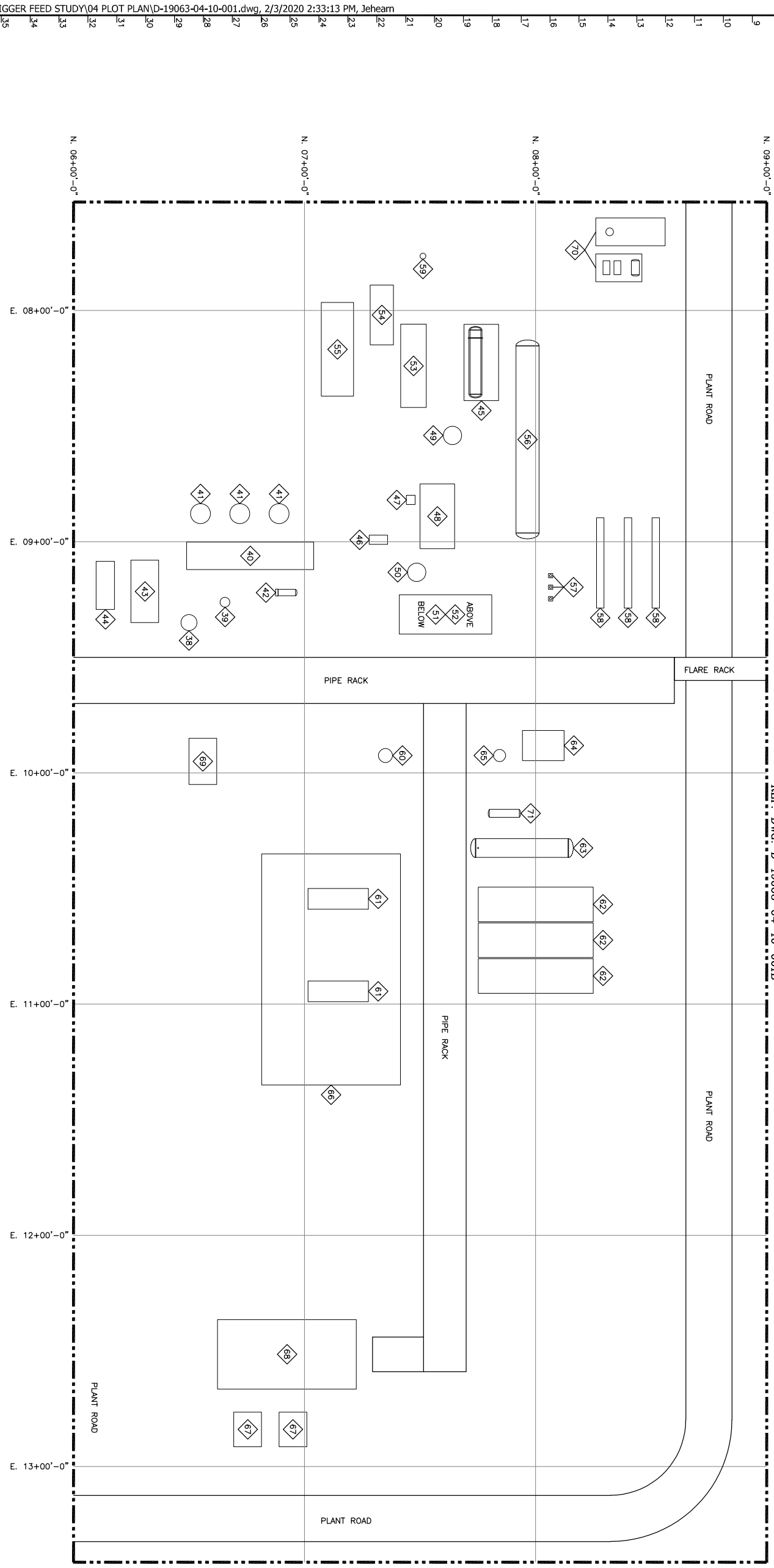
## Plant Layout and Equipment

## Grading Plan and Details

## Hydrology and Hydraulics Calculations

# Plant Layout and Equipment

R:\01-Projects design\19063 OUTRIGGER FEED STUDY\04 PLOT PLAN\D-19063-04-10-001.dwg, 2/3/2020 2:33:13 PM, Jehearn




| MARK | DESCRIPTION |
|---|---|
| 38 | DEHY INLET SCRUBBER |
| 39 | DEHY INLET COALESCING FILTER |
| 40 | DEHY VALVE SKID (402) |
| 41 | DEHYDRATOR |
| 42 | DEHYDRATOR DUST FILTER |
| 43 | REGEN GAS COMPRESSOR SKID (404) |
| 44 | REGEN GAS COOLER |
| 45 | REBOILER SKID (504) |
| 46 | GAS/GAS EXCHANGER |
| 47 | RSV SUBCOOLER HEAT EACHANGER |
| 48 | RSV VALVE SKID (508) |

| MARK | DESCRIPTION |
|---|---|
| 49 | DEMETHANIZER |
| 50 | COLD SEPARATOR |
| 51 | PROPANE SUBCOOLER SKID (502) |
| 52 | PROPANE CHILLER SKID (501) |
| 53 | EXPANDER VALVE SKID (507) |
| 54 | EXPANDER/COMPRESSOR |
| 55 | BOOSTER COMPRESSOR VALVE SKID (506) |
| 56 | NGL SURGE TANK |
| 57 | NGL BOOSTER PUMP |
| 58 | NGL PIPE LINE PUMP |
| 59 | CRYO AREA SUMP W/PUMP |

| MARK | DESCRIPTION |
|---|---|
| 60 | PROPANE COMP. SUCTION SCRUBBER |
| 61 | PROPANE COMPRESSOR |
| 62 | PROPANE CONDENSER |
| 63 | PROPANE ACCUMULATOR |
| 64 | PROPANE VALVE SKID (801) |
| 65 | PROPANE ECONOMIZER |
| 66 | PROPANE COMPRESSOR BUILDING |
| 67 | TRANSFORMER |
| 68 | PDC #2 BUILDING |
| 69 | G.C. BUILDING |
| 70 | TRIM REBOILER HOT OIL PACKAGE |
| 71 | PROPANE STORAGE TANK |

**BCCK CONFIDENTIAL INFORMATION**

OUTRIGGER ENERGY II, LLC.
SANDERSON PLANT
WILLIAMS COUNTY, NORTH DAKOTA

# NORTH PROCESS AREA PLOT PLAN

| REV. | DWG. No. |
|---|---|
| B | D-19063-04-10-001D |

BCCK ENGINEERING, INC.
BUSINESS CONFIDENTIAL
2500 N. Big Spring
Midland, Texas 79705
(432) 685-6095

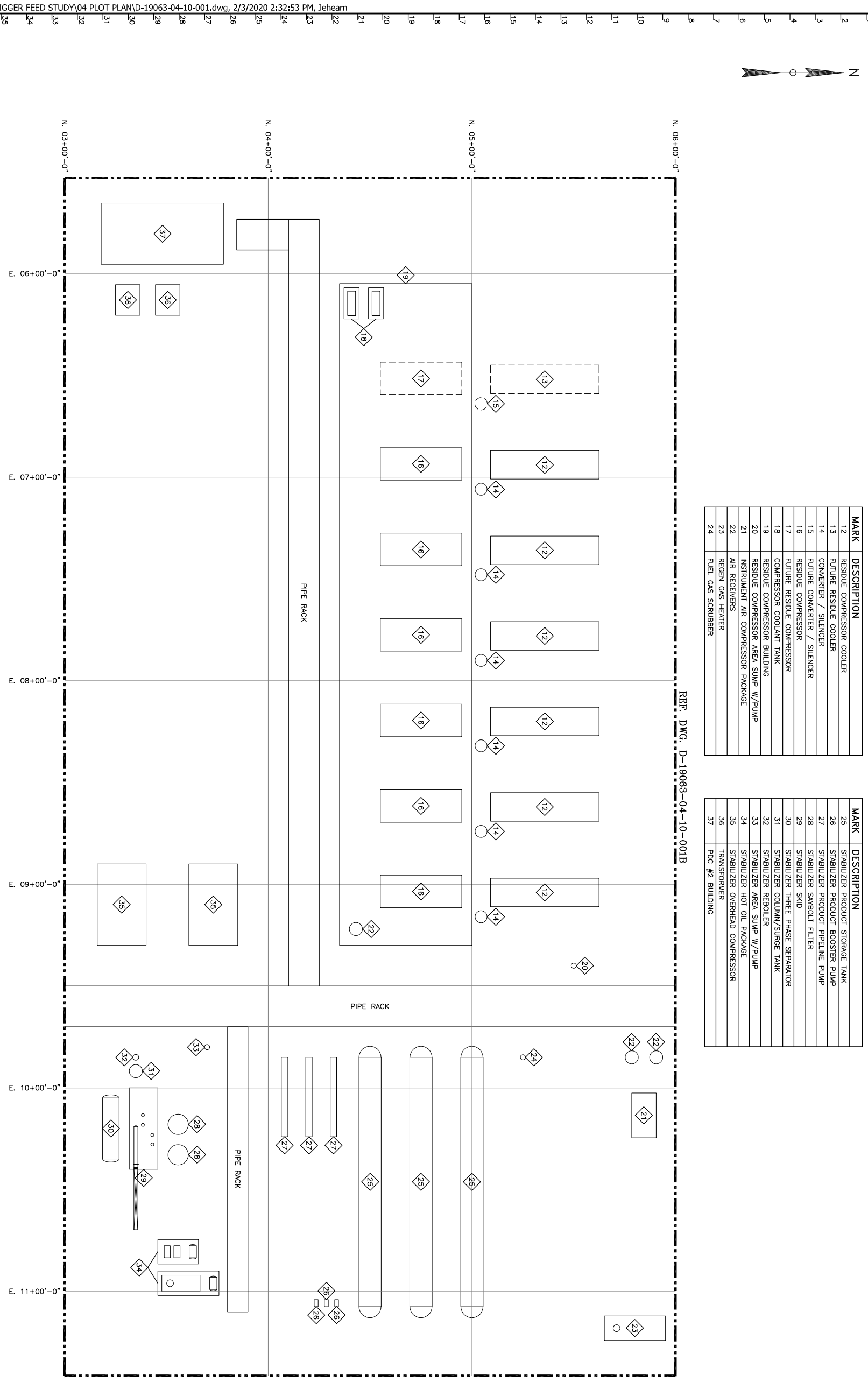
| | NAME | DATE |
|---|---|---|
| DESIGN | JEH | 12/19 |
| DRAWN | JEH | 1/20 |
| CHK. | | |
| Q. A. | | |
| CAD FILE | D-19063-04-10-001 | |
| PLOT DATE | | |
| SCALE | 1"=25'-0" | |

| | NAME | DATE |
|---|---|---|
| C/S | | |
| ELECT. | | |
| INSTR. | | |
| PROC. | | |
| MECH. | | |
| PIPING | | |
| PROJ. MGR. | | |

| REF. DWG. NUMBER | REFERENCE DWG TITLE |
|---|---|
| | |
| | |
| | |
| | |

| NO | DATE | REVISIONS | D/C | APP. |
|---|---|---|---|---|
| B | 2/3/20 | REVISED PER CLIENT COMMENTS | JEH RWD | JEH |
| A | 1/24/20 | ISSUED FOR BID | JEH RWD | JEH |

R:\01-Projects design\19063 OUTRIGGER FEED STUDY\04 PLOT PLAN\D-19063-04-10-001.dwg, 2/3/2020 2:32:53 PM, Jehearn




REF. DWG. D-19063-04-10-001B

| MARK | DESCRIPTION |
|---|---|
| 12 | RESIDUE COMPRESSOR COOLER |
| 13 | FUTURE RESIDUE COOLER |
| 14 | CONVERTER / SILENCER |
| 15 | FUTURE CONVERTER / SILENCER |
| 16 | RESIDUE COMPRESSOR |
| 17 | FUTURE RESIDUE COMPRESSOR |
| 18 | COMPRESSOR COOLANT TANK |
| 19 | RESIDUE COMPRESSOR BUILDING |
| 20 | RESIDUE COMPRESSOR AREA SUMP W/PUMP |
| 21 | INSTRUMENT AIR COMPRESSOR PACKAGE |
| 22 | AIR RECEIVERS |
| 23 | REGEN GAS HEATER |
| 24 | FUEL GAS SCRUBBER |

| MARK | DESCRIPTION |
|---|---|
| 25 | STABILIZER PRODUCT STORAGE TANK |
| 26 | STABILIZER PRODUCT BOOSTER PUMP |
| 27 | STABILIZER PRODUCT PIPELINE PUMP |
| 28 | STABILIZER SAYBOLT FILTER |
| 29 | STABILIZER SKID |
| 30 | STABILIZER THREE PHASE SEPARATOR |
| 31 | STABILIZER COLUMN/SURGE TANK |
| 32 | STABILIZER REBOILER |
| 33 | STABILIZER AREA SUMP W/PUMP |
| 34 | STABILIZER HOT OIL PACKAGE |
| 35 | STABILIZER OVERHEAD COMPRESSOR |
| 36 | TRANSFORMER |
| 37 | PDC #2 BUILDING |

**BCCK CONFIDENTIAL INFORMATION**

OUTRIGGER ENERGY II, LLC.
SANDERSON PLANT
WILLIAMS COUNTY, NORTH DAKOTA

# SOUTH PROCESS AREA PLOT PLAN

| REV. | DWG. No. |
|---|---|
| B | D-19063-04-10-001C |

BCCK ENGINEERING, INC.
BUSINESS CONFIDENTIAL
2500 N. Big Spring
Midland, Texas 79705
(432) 685-6095

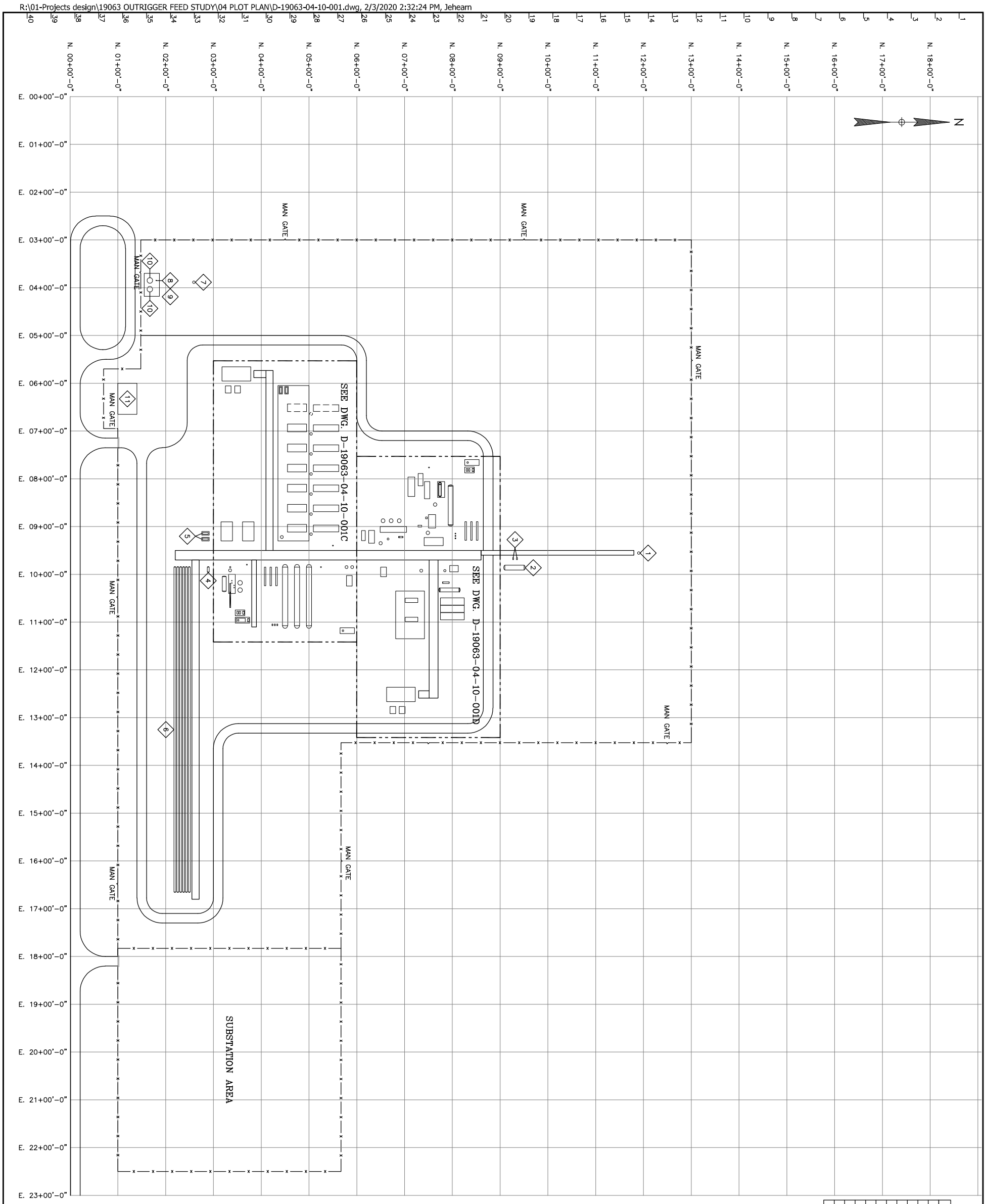
| | NAME | DATE |
|---|---|---|
| DESIGN | JEH | 12/19 |
| DRAWN | JEH | 1/20 |
| CHK. | | |
| Q. A. | | |
| CAD FILE | D-19063-04-10-001 | |
| PLOT DATE | | |
| SCALE | 1"=25'-0" | |

| | NAME | DATE |
|---|---|---|
| C/S | | |
| ELECT. | | |
| INSTR. | | |
| PROC. | | |
| MECH. | | |
| PIPING | | |
| PROJ. MGR. | | |

| REF. DWG. NUMBER | REFERENCE DWG TITLE |
|---|---|
| | |

| NO | DATE | REVISIONS | D/C | APP. |
|---|---|---|---|---|
| B | 2/3/20 | REVISED PER CLIENT COMMENTS | JEH / RWD | JEH |
| A | 1/24/20 | ISSUED FOR BID | JEH / RWD | JEH |

R:\01-Projects design\19063 OUTRIGGER FEED STUDY\04 PLOT PLAN\D-19063-04-10-001.dwg, 2/3/2020 2:32:24 PM, Jehearn




| MARK | DESCRIPTION |
|---|---|
| 1 | FLARE STACK |
| 2 | FLARE K.O. DRUM |
| 3 | FLARE K.O. DRUM PUMP |
| 4 | CLOSED DRAIN FLASH TANK |
| 5 | STABILIZER COMPRESSOR L.O. TANKS |
| 6 | HARP SLUG CATCHER |
| 7 | TANK FARM FLARE |
| 8 | TANK FARM FLARE K.O. |
| 9 | TANK FARM FLARE K.O. PUMP |
| 10 | SLOP TANK |
| 11 | CCR/WAREHOUSE |

**BCCK CONFIDENTIAL INFORMATION**

OUTRIGGER ENERGY II, LLC.
SANDERSON PLANT
WILLIAMS COUNTY, NORTH DAKOTA

# OVERALL PLOT PLAN

| REV. | DWG. No. |
|---|---|
| B | D-19063-04-10-001B |

BCCK ENGINEERING, INC.

BUSINESS CONFIDENTIAL
2500 N. Big Spring
Midland, Texas 79705
(432) 685-6095

| | NAME | DATE |
|---|---|---|
| DESIGN | JEH | 12/19 |
| DRAWN | JEH | 1/20 |
| CHK. | | |
| Q. A. | | |
| CAD FILE | D-19063-04-10-001 | |
| PLOT DATE | | |
| SCALE | 1"=100'-0" | |

| | NAME | DATE |
|---|---|---|
| C/S | | |
| ELECT. | | |
| INSTR. | | |
| PROC. | | |
| MECH. | | |
| PIPING | | |
| PROJ. MGR. | | |

| REF. DWG. NUMBER | REFERENCE DWG TITLE |
|---|---|

| NO | DATE | REVISIONS | D/C | APP. |
|---|---|---|---|---|
| B | 2/3/20 | REVISED PER CLIENT COMMENTS | JEH RWD | JEH |
| A | 1/24/20 | ISSUED FOR BID | JEH RWD | JEH |

# Grading Plan and Details Sheets

## APPROXIMATE EARTHWORK VOLUMES
COMPARING FINISHED TO EXISTING SURFACES

| LOCATION | AREA (SF) | CUT (CY) | FILL (CY) | NET (CY) | COMMENTS |
|---|---|---|---|---|---|
| PLANT SITE | 1,548,504 | 165,947 | 192,212 | 26,265 FILL | INCLUDES 6" SURFACING MATERIAL |
| EMBANKMENT | 10,500 | – | 2,388 | 2,388 FILL | EXCLUDES CUT FOR EMANKMENT KEY |
| COUNTY ROAD | 65,600 | NA | NA | NA | SURFACE SOUTH OF SITE IS UNAVAILABLE |

REGISTERED PROFESSIONAL ENGINEER
CHRIS D PATTEN
PE-28413
DATE 2/11/20
NORTH DAKOTA

Chris D. Patten
Matix Corporation
chris.patten@matixcorp.com
(385) 226-5966

### LEGEND
- EXISTING CONTOUR (2')
- EXISTING CONTOUR (10')
- PROPOSED CONTOUR (2')
- PROPOSED CONTOUR (10')
- PROPOSED DRAINAGE FLOWLINE
- PROPOSED FENCE
- ROAD ALIGNMENT

75 0 75 150
SCALE OF FEET

### GRADING NOTES
1. COORDINATES GIVEN ON THIS DRAWING ARE PLANT COORDINATES BASED ON A SYSTEM WITH THE ORIGIN AT N 0+00 AND E 0+00. REFER TO PLOT PLAN.
2. BENCHMARK GIVEN ON THIS DRAWING IS BASED UPON THE NORTH DAKOTA STATE PLANE COORDINATE SYSTEM IN THE NAD83 DATUM, NORTH ZONE, IN U.S. SURVEY FEET.
3. PROPOSED GRADE ELEVATIONS ARE TOP OF FINISH GRADE CONSIDERING SURFACING MATERIAL.
4. CUT AND FILL SLOPES SHALL BE 3H:1V, UNLESS NOTED. NO SLOPE SHALL BE STEEPER THAN 2:1.
5. ROADWAYS, TRUCK LOADING AND PARKING AREAS SHALL BE CONSTRUCTED WITH PREPARED SUBGRADES AND ROAD BASE MATERIALS RECOMMENDED IN THE GEOTECHNICAL REPORT AND AS SHOWN IN THESE DRAWINGS.
6. SUBSTATION SHALL INCLUDE 12" ROAD BASE WITHIN FENCED AREA.
7. SURFACE SITE WITH 4" MINUS CLINKER (SCORIA) TO A DEPTH OF 6" MINIMUM WITHIN GRADED AREA. IN AREAS WHERE HEAVY EQUIPMENT IS ANTICIPATED, INSTALL A GEOSYNTHETIC FABRIC BETWEEN SUBGRADE AND SURFACING MATERIAL TO PREVENT RUTTING IN WET CONDITIONS. GEOSYNTHETIC SHALL BE MIRAFI RS580i OR EQUAL. INSTALL AS RECOMMENDED BY MANUFACTURER.
8. TOP SOIL MATERIAL SHALL BE PLACED ONTO CUT AND FILL SLOPES OR AREAS TO BE RESTORED TO PRECONSTRUCTION CONDITIONS. PLACE TO A DEPTH OF 6" WITH THE REMAINING TOP SOIL BEING EXPORTED TO A LOCATION OFFSITE. RESTORE SLOPES WITH NATURAL VEGETATION.
9. LINE CHANNEL WITH GEOTEXTILE OVERLAIN WITH 12" MINIMUM QUARRY SPALLS.
10. SMOOTH CORRUGATED POLYETHYLENE (SCPE) PIPE SHALL BE ADS N-12 (ASTM F2648) OR EQUAL
11. REINFORCED CONCRETE PIPE (RCP) SHALL BE IN ACCORDANCE WITH ASTM C76 AND C443.
12. EARTHWORK SPECIFICATIONS CONTAIN ADDITIONAL REQUIREMENTS.

### EMBANKMENT NOTES
A. BASIN SLOPES, SURFACE, AND EMBANKMENT SHALL BE CONSTRUCTED AS INDICATED IN THESE DRAWINGS AND IN ACCORDANCE WITH GEOTECHNICAL RECOMMENDATIONS. CONSTRUCTION SHALL BE VISUALLY OBSERVED AND APPROVED BY A PROJECT REPRESENTATIVE.

END OF SPILLWAY CHANNEL MATCH EXIST GRADE
OUTFALL 002A
SPILLWAY CHANNEL
TOP OF EMBANKMENT 2188.80. SEE NOTE A
SPILLWAY CREST 2187.80
CUTOFF BERM SEE DETAIL 2/002B
OUTLET CONTROL STRUCTURE
100 YR WATER SURFACE 2187.63
CHECK DAM SEE DETAIL 3/S002B
CHECK DAM SEE DETAIL 3/S002B
DRAINAGE SWALE SEE NOTE 9
MAINTENANCE ROAD SEE C/S002B, TYP
SUBSTATION
PARKING AREA
TRUCK LOADING AREA
PLANT ACCESS SEE B/S002B
FG 2236.06
END FG 2242.00 STA: 30+50.00
GRADE BREAK 2242.00 STA: 27+66.16
FG 2241.77 STA: 25+75.00
DRAINAGE DITCH SEE DETAIL 1/002B
INV OUT: 2239.1
15" SCPE CULVERT INV IN: 2240.5
GRADE BREAK 2244.00 STA: 20+23.88
INV OUT: 2238.6
15" SCPE CULVERT INV IN: 2239.9
FG 2239.59
15" SCPE CULVERT
INV IN: 2230.8
FG 2243.52 STA: 14+15.00
SUBSTATION ACCESS SEE B/S002B
INV OUT: 2229.9
GRADE BREAK 2244.00 STA: 14+00.67
DRAINAGE DITCH SEE DETAIL 1/002B
COUNTY ROAD SEE A/S002B
BEGIN FG 2232.93 STA: 10+00.00

| NO | DATE | REVISIONS | D/C | APP |
|---|---|---|---|---|
| 0 | 2/11/20 | ISSUE FOR CONSTRUCTION | | |

| | NAME | DATE |
|---|---|---|
| C/S | C. PATTEN | JAN 20 |
| ELECT. | | |
| INSTR. | | |
| PROC. | | |
| MECH. | | |
| PIPING | | |
| PROJ. MGR. | | |

| | NAME | DATE |
|---|---|---|
| DESIGN | C. PATTEN | JAN 20 |
| DRAWN | A. NOBIS | JAN 20 |
| CHK. | | |
| Q. A. | | |

CAD FILE: D19063-04-10-002.dwg
PLOT DATE: 2/11/2020
SCALE: 1" = 75'-0"

BCCK CONFIDENTIAL INFORMATION

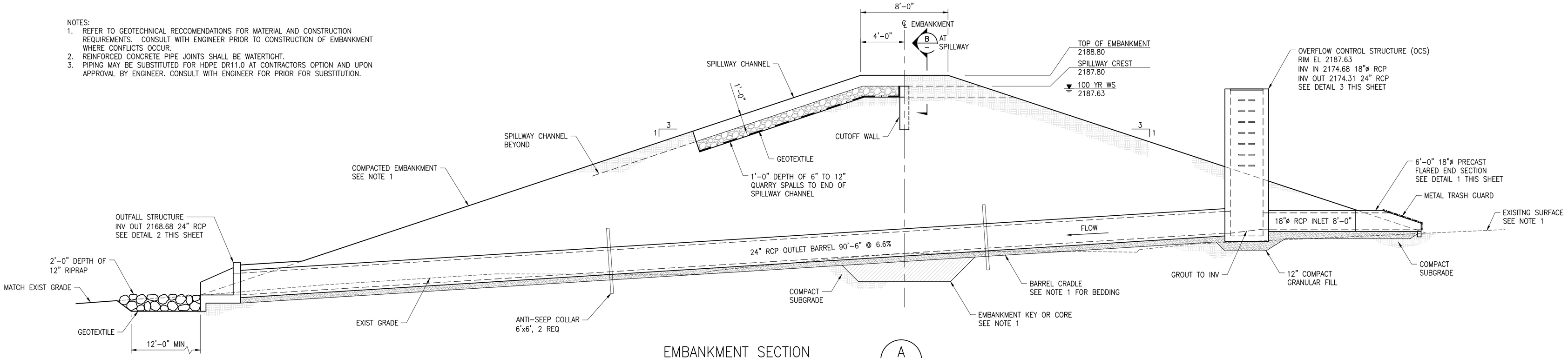
GRADING PLAN

OUTRIGGER ENERGY II, LLC.
SANDERSON PLANT
WILLIAMS COUNTY, NORTH DAKOTA

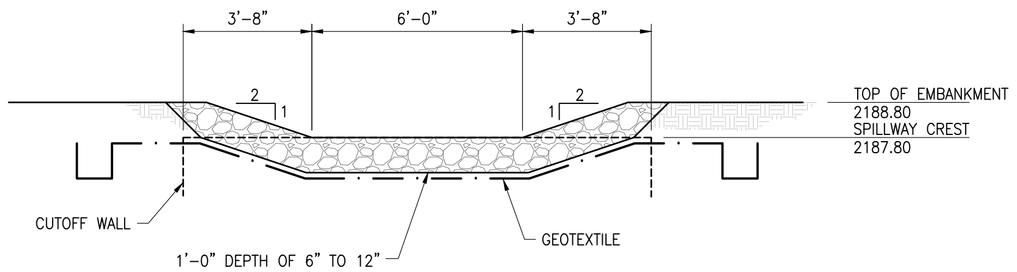
BCCK ENGINEERING, INC.
BUSINESS CONFIDENTIAL
2004 N. Big Spring St.
Midland, Texas 79705
(432) 685-6095

| REV. | DWG. No. |
|---|---|
| 0 | D-19063-04-10-002 |

NOTES:
1. REFER TO GEOTECHNICAL RECCOMENDATIONS FOR MATERIAL AND CONSTRUCTION REQUIREMENTS. CONSULT WITH ENGINEER PRIOR TO CONSTRUCTION OF EMBANKMENT WHERE CONFLICTS OCCUR.
2. REINFORCED CONCRETE PIPE JOINTS SHALL BE WATERTIGHT.
3. PIPING MAY BE SUBSTITUTED FOR HDPE DR11.0 AT CONTRACTORS OPTION AND UPON APPROVAL BY EINGINEER. CONSULT WITH ENGINEER FOR PRIOR FOR SUBSTITUTION.

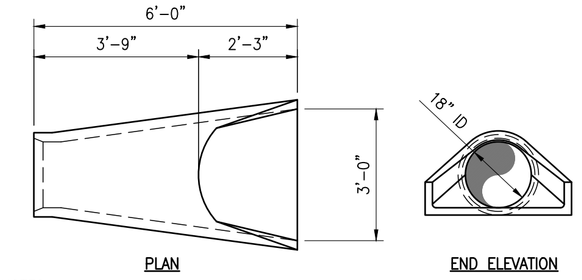



## EMBANKMENT SECTION — A
SCALE: NTS
SHT 002



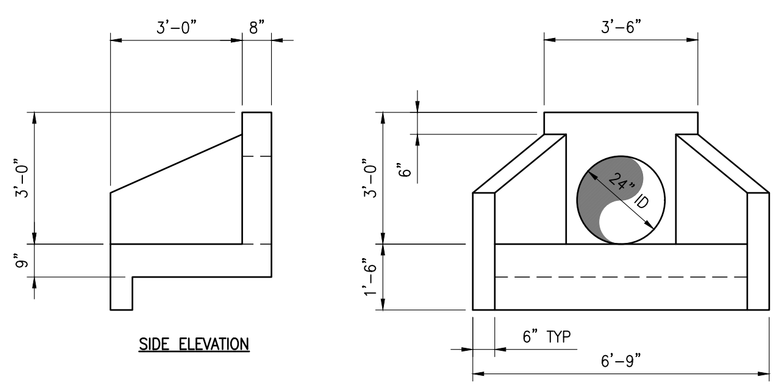

NOTES:
1. ANTI-SEEP COLLAR SHALL BE 10" THICK BY 48" HIGH AND REINFORCED WITH #5@12" EACH WAY CENTERED IN WALL.

## SPILLWAY SECTION — B
SCALE: NTS



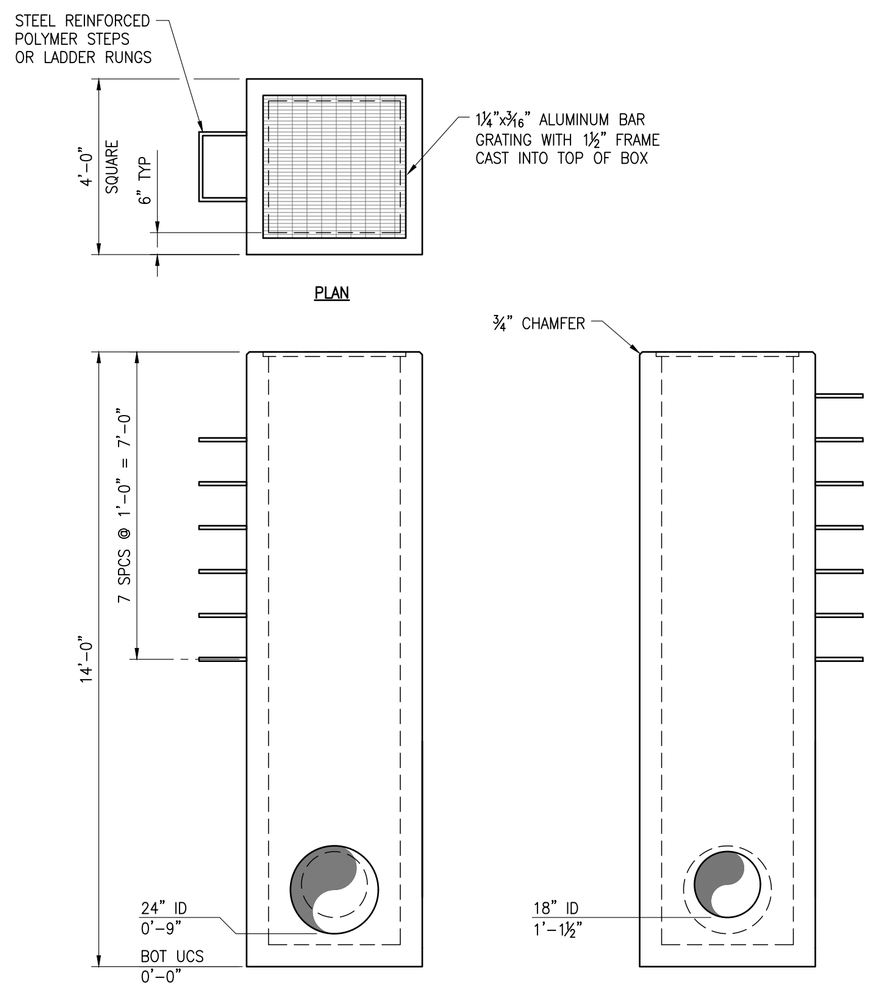

NOTES:
1. PRECAST CONCRETE SHALL HAVE A 4,000 PSI MINIMUM COMPRESSIVE STRENGTH AT 28 DAYS.
2. SECTION SHALL BE REINFORCED.
3. OPENINGS SHOWN INDICATE INSIDE DIAMETER (ID) OF NOMINAL PIPE SIZE.
4. SUPPLIER SHALL PROVIDE METAL TRASH RACK WITH SECTION.

## PRECAST FLARED END DETAIL — 1
SCALE: 3/8"=1'-0"




NOTES:
1. PRECAST CONCRETE SHALL HAVE A 4,000 PSI MINIMUM COMPRESSIVE STRENGTH AT 28 DAYS.
2. REINFORCEMENT SHALL BE #4 AT 12" SPACING EACH WAY.
3. OPENINGS SHOWN INDICATE INSIDE DIAMETER (ID) OF NOMINAL PIPE SIZE.
4. EXPOSED EDGES SHALL BE CHAMFERED ¾".

## PRECAST OUTFALL DETAIL — 2
SCALE: 3/8"=1'-0"




NOTES:
1. PRECAST CONCRETE SHALL HAVE A 4,000 PSI MINIMUM COMPRESSIVE STRENGTH AT 28 DAYS.
2. REINFORCEMENT SHALL BE #4 AT 12" SPACING EACH WAY.
3. OPENINGS SHOWN INDICATE INSIDE DIAMETER (ID) OF NOMINAL PIPE SIZE.

## PRECAST OCS DETAIL — 3
SCALE: 3/8"=1'-0"

REGISTERED PROFESSIONAL ENGINEER
CHRIS D PATTEN
PE-28413
DATE 2/11/20
NORTH DAKOTA

Chris D. Patten
Matix Corporation
chris.patten@matixcorp.com
(385) 226-5966

| REVISIONS | DATE | APP |
|---|---|---|
| ISSUE FOR CONSTRUCTION | 2/11/20 | D/C |

| | NAME | DATE |
|---|---|---|
| C/S | C PATTEN | JAN 20 |
| ELECT. | | |
| INSTR. | | |
| PROC. | | |
| MECH. | | |
| PIPING | | |
| PROJ. MGR. | | |
| DESIGN | C PATTEN | |
| DRAWN | A NOBBS | JAN 20 |
| CHK. | | |
| Q. A. | | |

CAD FILE D19063-04-10-002A.dwg
PLOT DATE 2/11/2020
SCALE AS NOTED

REFERENCE DWG TITLE

REF. DWG. NUMBER

**BCCK CONFIDENTIAL INFORMATION**

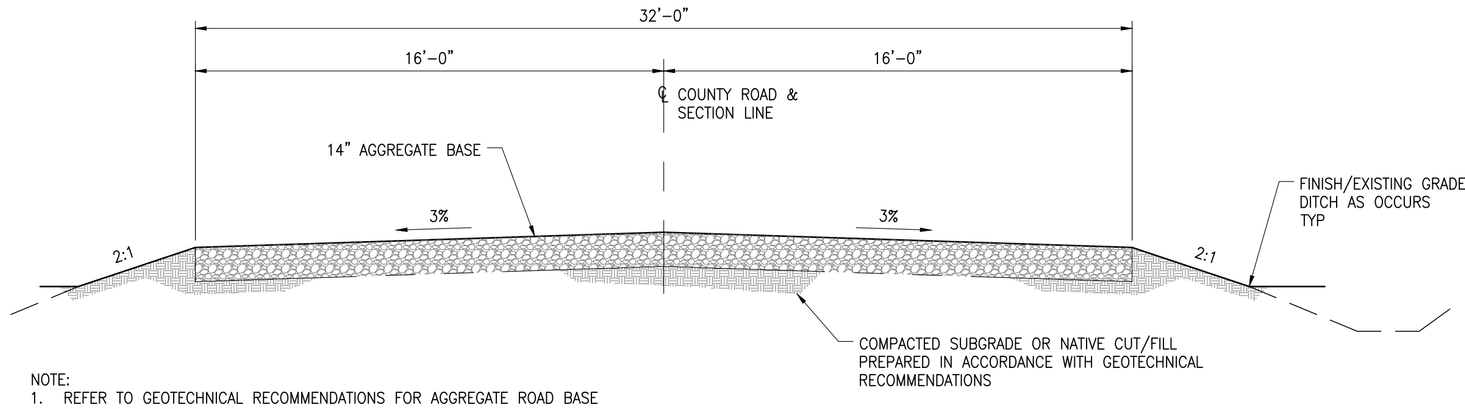
BUSINESS CONFIDENTIAL
2500 N. Big Spring
Midland, Texas 79705
(432) 685-8095

BCCK ENGINEERING, INC.

GRADING
SECTIONS AND DETAILS I

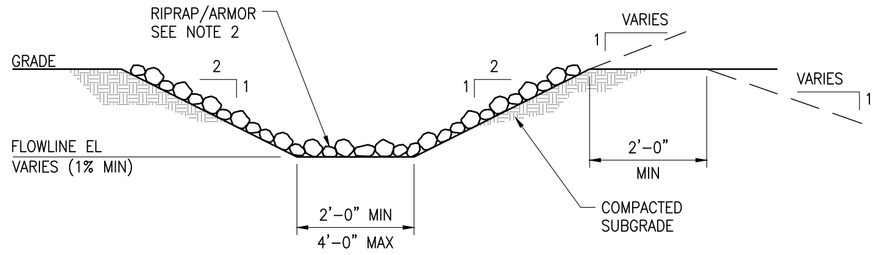
OUTRIGGER ENERGY II, LLC.
SANDERSON PLANT
WILLIAMS COUNTY, NORTH DAKOTA

REV. 0
DWG. No. D-19063-04-10-002A

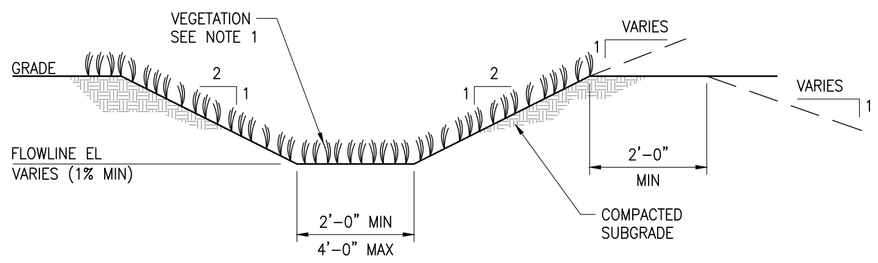



NOTE:
1. REFER TO GEOTECHNICAL RECOMMENDATIONS FOR AGGREGATE ROAD BASE MATERIAL REQUIREMENTS.
2. SEE DITCH DETAILS WHERE DITCH OCCURS PER GRADING AND DRAINAGE PLAN.

## COUNTY ROAD SECTION — A
SCALE: NTS — SHT 002



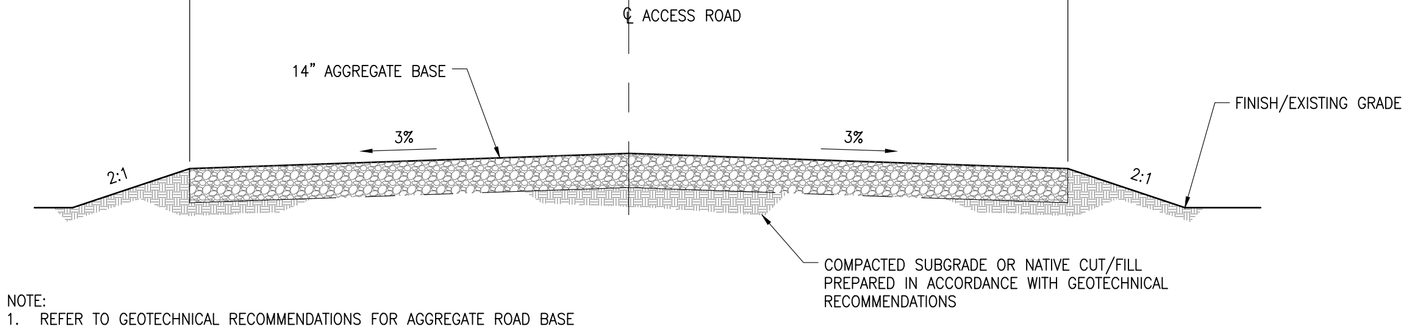

## ARMORED DITCH




## GRASS-LINED DITCH

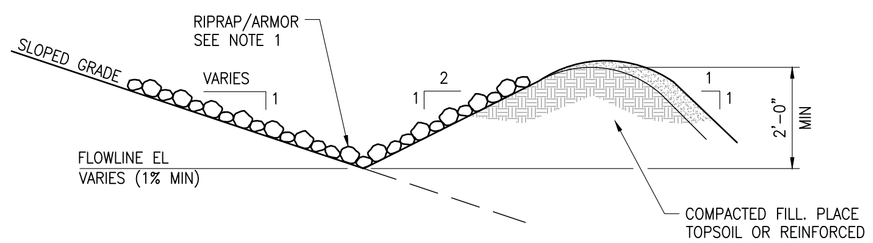
NOTES:
1. NATURAL OR RESTORED CHANNELS SHALL BE RESEEDED WITH NATIVE VEGETATION.
2. RIPRAP ARMOR SHALL BE 4" MINIMUM DIAMETER.

## DITCH DETAILS — 1
SCALE: NTS — SHT 002




NOTE:
1. REFER TO GEOTECHNICAL RECOMMENDATIONS FOR AGGREGATE ROAD BASE MATERIAL REQUIREMENTS.

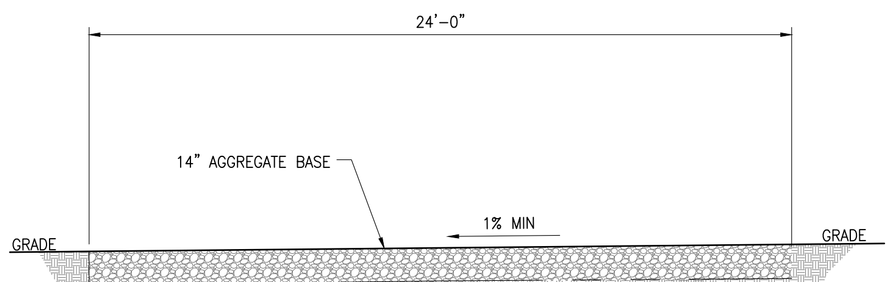
## ACCESS ROAD SECTION — B
SCALE: NTS — SHT 002




## ARMORED BERM

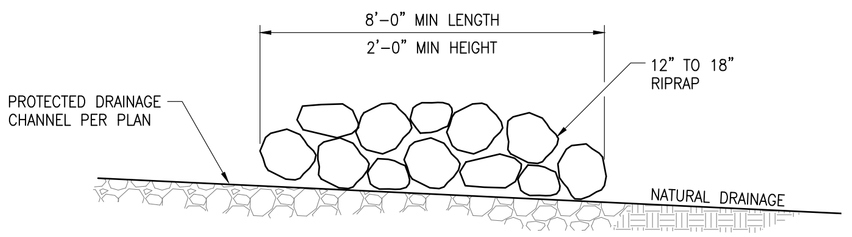
NOTES:
1. RIPRAP ARMOR SHALL BE 4" MINIMUM DIAMETER.

## EARTHEN BERM — 2
SCALE: NTS — SHT 002




NOTE:
1. REFER TO GEOTECHNICAL RECOMMENDATIONS FOR AGGREGATE ROAD BASE MATERIAL REQUIREMENTS.

## MAINTENANCE ROAD SECTION — C
SCALE: NTS — SHT 002




## CHECK DAM — 3
SCALE: NTS — SHT 002

| NO | DATE | REVISIONS | D/C | APP |
|---|---|---|---|---|
| 0 | 2/11/20 | ISSUE FOR CONSTRUCTION | | |

| | NAME | DATE |
|---|---|---|
| DESIGN | C PATTEN | JAN 20 |
| DRAWN | A NOBBS | JAN 20 |
| CHK. | | |
| Q. A. | | |

C/S
ELECT.
INSTR.
PROC.
MECH.
PIPING
PROJ. MGR.

CAD FILE: D1963-04-10-002B.dwg
PLOT DATE: 2/11/2020
SCALE: AS NOTED

REFERENCE DWG TITLE
REF. DWG. NUMBER

**BCCK CONFIDENTIAL INFORMATION**

OUTRIGGER ENERGY II, LLC.
SANDERSON PLANT
WILLIAMS COUNTY, NORTH DAKOTA

# GRADING SECTIONS AND DETAILS II

BCCK ENGINEERING, INC.
BUSINESS CONFIDENTIAL
2500 N. Big Spring
Midland, Texas 79705
(432) 685-8095

REGISTERED PROFESSIONAL ENGINEER
CHRIS D PATTEN
PE-28413
DATE 2/11/20
NORTH DAKOTA

Chris D. Patten
Matix Corporation
chris.patten@matixcorp.com
(385) 226-5966

REV. 0
DWG. No. D-19063-04-10-002B

# Hydrology and Hydraulics Calculations

# Sanderson Plant Hydrology and Hydraulics Calculations

Williams County, North Dakota

Structural Calculations

February 2020


Directed by: Chris Patten, PE
Professional Engineer

**Matix Corporation**
2290 E 4500 S Ste 100
Salt Lake City, UT 84117
**(385) 226-5966**
www.matixcorp.com

| INDEX OF REVISIONS | | | |
|---|---|---|---|
| **Rev** | **Description** | **Date** | **By** |
| A | Issued to Information | 2/12/2020 | C. Patten |

## PROJECT DESCRIPTION

The Sanderson Plant is located in Williams County, North Dakota at approximately 48°07'33.30" North and 104°02'27.73" West. From the provided project topography, the property slopes to the north at approximately 6% maximum slope. Google Earth indicates that the property is vegetated with various prairie grasses. From preliminary geotechnical boring logs, the soils would be classified as a Group C soil, which include clay loams and shallow sandy loam.

It is understood that the proposed graded pad will be surfaced with compacted Scoria rock. The side slopes of the pad will be compacted native soils. A detention pond will be designed in the existing channel to the west of the site and tributary flows on the south side of the adjacent county road will be routed around the completed site and therefore, will not be tributary to the finished storm drainage detention pond.

## CONTENTS OF THIS REPORT

- Methodology Section with written explanation of the calculations
- NOAA Atlas storm intensities for the project location
- Hydraflow Express analysis of spillway channel

## METHODOLOGY

The rational method was used to calculate the expected maximum surface drainage flows. The numbers used in the calculation are in the following table, with justification for the numbers below.

| Pervious Areas | | C | Longest Length of Basin (ft) | Average Slope (%) | k | Velocity (fps) | Calculated Travel Time (min) | Rounded Travel Time (min) | Intensity (in/hr) | Q' Runoff (cfs) |
|---|---|---|---|---|---|---|---|---|---|---|
| 43.02 | acres | 0.35 | 2270 | 3.6% | 4.5 | 0.86 | 44.09 | 60 | 2.35 | **35.38** |
| | | | | | | | | | Peak Discharge (cfs/acre) | **0.82** |

- Area was taken from AutoCAD and is the area tributary to the proposed the detention basin embankment, not including south of the county road.
- Runoff Coefficient C value is from Richard McCuen's *Hydrologic Analysis and Design* Table 7-9. This value (0.35) is for a Meadow Site, 2-6% slope for Soil Group C, 25+ year storm.
- Longest Length of Basin and Average Slope are from AutoCAD for computing the time of concentration using the Velocity Method.
- A k value of 4.5 is from Richard McCuen's *Hydrologic Analysis and Design* Table 3-14. This value (4.5) is for a trash fallow because a significant portion of the drainage will be concentrated and should be somewhere between rangeland (value of 1.3) and short grass pasture (value of 3.0) from the same table.

- The calculated travel time of 44.09 minutes was checked using the Watershed Lag Method. Using the same length and slope above, and a CN value of 71, the time of concentration calculates to be 41.91 minutes, which is similar to the Velocity method result.
- A rounded travel time of 60 minutes was used with a corresponding storm intensity of 2.35 inches per hour. The storm intensities were obtained from the NOAA Atlas for the project location. A storm intensity of 45 minutes could have been used, but in this case, a 60-minute storm intensity will actually yield a more conservative result since a 45-minute storm would yield a higher runoff rate and therefore, a smaller detention basin required volume.
- The peak discharge from the site is therefore 35.38 cfs and dividing by the project area, the result is 0.82 cfs/acre maximum historical discharge rate. The historical discharge rate will be the maximum outflow from the detention basin and was used in the detention basin sizing spreadsheet.

The detention basing was sized using the following spreadsheet:

**Area and Weighted C Calculation**

| Description | Acres | C |
|---|---|---|
| Scoria finished surface | 27.81 | 0.80 |
| Native soil side slopes | 3.76 | 0.44 |
| Total Improved area | 31.57 | 0.76 |
| Total unimproved area | 11.45 | 0.35 |
| **Total:** | 43.02 | **0.65** |

**Storage requirements by duration (maximum volume is bolded)**

| Duration (min) | $C_w$ | i (100 yr.) | Area (ac) | Q(cfs) | Vol. (cf) | Allowable Release (cf) | Storage (cf) | Storage (ac-ft) |
|---|---|---|---|---|---|---|---|---|
| 5 | 0.65 | 9.79 | 43.02 | 273.76 | 82,127 | 10,582.9 | 71,544 | 1.64 |
| 10 | 0.65 | 7.17 | 43.02 | 200.49 | 120,297 | 21,165.8 | 99,131 | 2.28 |
| 15 | 0.65 | 5.83 | 43.02 | 163.02 | 146,722 | 31,748.8 | 114,973 | 2.64 |
| 30 | 0.65 | 3.84 | 43.02 | 107.38 | 193,280 | 63,497.5 | **129,783** | 2.98 |
| 60 | 0.65 | 2.35 | 43.02 | 65.71 | 236,567 | 126,995.0 | 109,572 | 2.52 |
| 120 | 0.65 | 1.39 | 43.02 | 38.87 | 279,854 | 253,990.1 | 25,864 | 0.59 |
| 180 | 0.65 | 1.00 | 43.02 | 27.85 | 300,792 | 380,985.1 | -80,193 | -1.84 |
| 360 | 0.65 | 0.56 | 43.02 | 15.66 | 338,240 | 761,970.2 | -423,730 | -9.73 |
| 720 | 0.65 | 0.31 | 43.02 | 8.67 | 374,480 | 1,523,940.5 | -1,149,460 | -26.39 |
| 1,440 | 0.65 | 0.17 | 43.02 | 4.75 | 410,721 | 3,047,881.0 | -2,637,160 | -60.54 |
| | | | | | | Allowable release (cfs/ac) | | 0.82 |

The maximum storage volume for the 100-year storm event is 129,783 cubic feet.

The orifice size in the proposed detention basin outlet structure has been calculated using the proposed maximum pond water height of 13 feet and is as follows:

| Orifice Size | |
|---|---|
| C (sharp edge constant) | 0.61 |
| Q (release rate x area, cfs) | 35.276 |
| H (Depth of pond, ft) | 13 |
| A (Area of orifice, $ft^2$) | 1.999 |
| A (Area of orifice, $in^2$) | 287.8 |
| r (radius of orifice, in) | 9.6 |
| Diameter of Orifice (in) | **19.1** |

$$A = \frac{Q}{C\sqrt{2gh}}$$

$$r = \sqrt{\frac{A}{\pi}}$$

The orifice may be designed to be a round hole of 19.0" diameter hole or a rectangle that equals 287.8 square inches.

The outgoing pipe from the detention pond outlet structure should be one pipe size larger than the calculated orifice. We therefore recommend a 24" diameter pipe.

It is our understanding that an emergency spillway will be constructed on the proposed pond embankment. We recommend that the spillway be large enough to carry the historical discharge flow from the site, should the pond outlet structure plug or otherwise malfunction. The spillway should be a trapezoidal shape with 6' bottom width and 2:1 side slopes. Using Hydraflow Express, a channel with these dimensions was modeled. Using a conservative mannings n value of 0.05, the historical discharge flow results in a 6" water depth in the channel and therefore, the spillway would maintain 12" freeboard if the channel total depth were 18". Results from the Hydralow analysis are included in this report.

**NOAA Atlas 14, Volume 8, Version 2**
**Location name: Williston, North Dakota, USA***
**Latitude: 48.1273°, Longitude: -104.0405°**
**Elevation: 2236.04 ft****
* source: ESRI Maps
** source: USGS

**POINT PRECIPITATION FREQUENCY ESTIMATES**

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

## PF tabular

**PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]**

| Duration | Average recurrence interval (years) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 5 | 10 | 25 | 50 | 100 | 200 | 500 | 1000 |
| 5-min | **2.80** (2.17-3.64) | **3.37** (2.62-4.39) | **4.44** (3.43-5.80) | **5.45** (4.18-7.14) | **7.00** (5.28-9.73) | **8.34** (6.11-11.7) | **9.79** (6.94-14.1) | **11.4** (7.75-16.8) | **13.7** (8.96-20.8) | **15.6** (9.88-23.8) |
| 10-min | **2.05** (1.59-2.66) | **2.47** (1.91-3.22) | **3.25** (2.51-4.24) | **3.98** (3.06-5.23) | **5.12** (3.86-7.13) | **6.10** (4.48-8.56) | **7.17** (5.08-10.3) | **8.35** (5.67-12.3) | **10.0** (6.56-15.2) | **11.4** (7.23-17.4) |
| 15-min | **1.66** (1.29-2.16) | **2.01** (1.56-2.61) | **2.64** (2.04-3.45) | **3.24** (2.49-4.25) | **4.16** (3.14-5.80) | **4.96** (3.64-6.96) | **5.83** (4.13-8.39) | **6.78** (4.61-10.0) | **8.16** (5.33-12.4) | **9.29** (5.88-14.2) |
| 30-min | **1.12** (0.866-1.45) | **1.34** (1.04-1.75) | **1.76** (1.36-2.30) | **2.16** (1.66-2.83) | **2.76** (2.08-3.84) | **3.28** (2.40-4.60) | **3.84** (2.72-5.53) | **4.46** (3.03-6.59) | **5.35** (3.50-8.12) | **6.08** (3.85-9.28) |
| 60-min | **0.696** (0.540-0.905) | **0.836** (0.648-1.09) | **1.09** (0.844-1.43) | **1.33** (1.02-1.75) | **1.70** (1.28-2.36) | **2.01** (1.47-2.82) | **2.35** (1.66-3.38) | **2.72** (1.85-4.02) | **3.25** (2.12-4.93) | **3.69** (2.33-5.63) |
| 2-hr | **0.418** (0.328-0.536) | **0.500** (0.392-0.644) | **0.652** (0.510-0.842) | **0.793** (0.616-1.03) | **1.01** (0.768-1.38) | **1.19** (0.882-1.65) | **1.39** (0.994-1.97) | **1.61** (1.10-2.34) | **1.91** (1.26-2.86) | **2.17** (1.39-3.26) |
| 3-hr | **0.307** (0.242-0.392) | **0.367** (0.289-0.468) | **0.475** (0.374-0.608) | **0.575** (0.450-0.740) | **0.727** (0.557-0.987) | **0.857** (0.638-1.17) | **0.996** (0.717-1.40) | **1.15** (0.793-1.66) | **1.37** (0.907-2.02) | **1.54** (0.993-2.30) |
| 6-hr | **0.183** (0.146-0.230) | **0.216** (0.173-0.273) | **0.276** (0.220-0.349) | **0.330** (0.262-0.420) | **0.413** (0.320-0.552) | **0.483** (0.364-0.652) | **0.558** (0.406-0.771) | **0.639** (0.446-0.908) | **0.755** (0.507-1.10) | **0.848** (0.553-1.25) |
| 12-hr | **0.109** (0.088-0.135) | **0.127** (0.102-0.158) | **0.159** (0.128-0.198) | **0.188** (0.150-0.235) | **0.231** (0.181-0.304) | **0.267** (0.204-0.355) | **0.306** (0.225-0.417) | **0.348** (0.246-0.487) | **0.407** (0.276-0.585) | **0.455** (0.300-0.659) |
| 24-hr | **0.064** (0.052-0.079) | **0.074** (0.061-0.091) | **0.092** (0.075-0.114) | **0.108** (0.088-0.134) | **0.132** (0.104-0.170) | **0.151** (0.116-0.197) | **0.171** (0.127-0.229) | **0.192** (0.137-0.264) | **0.222** (0.152-0.314) | **0.246** (0.164-0.351) |
| 2-day | **0.037** (0.030-0.044) | **0.043** (0.035-0.052) | **0.053** (0.044-0.065) | **0.062** (0.051-0.076) | **0.075** (0.060-0.096) | **0.086** (0.067-0.110) | **0.096** (0.072-0.127) | **0.108** (0.078-0.145) | **0.123** (0.085-0.171) | **0.135** (0.091-0.190) |
| 3-day | **0.026** (0.022-0.032) | **0.031** (0.026-0.037) | **0.039** (0.032-0.047) | **0.045** (0.037-0.055) | **0.054** (0.044-0.068) | **0.062** (0.048-0.079) | **0.069** (0.052-0.090) | **0.077** (0.056-0.103) | **0.088** (0.061-0.121) | **0.096** (0.065-0.134) |
| 4-day | **0.021** (0.018-0.025) | **0.025** (0.021-0.030) | **0.031** (0.026-0.037) | **0.036** (0.030-0.043) | **0.043** (0.035-0.054) | **0.049** (0.038-0.062) | **0.055** (0.042-0.071) | **0.061** (0.044-0.081) | **0.069** (0.049-0.095) | **0.076** (0.052-0.105) |
| 7-day | **0.014** (0.012-0.017) | **0.016** (0.014-0.019) | **0.020** (0.017-0.024) | **0.023** (0.020-0.028) | **0.028** (0.023-0.034) | **0.031** (0.025-0.039) | **0.035** (0.027-0.044) | **0.038** (0.028-0.051) | **0.044** (0.031-0.059) | **0.047** (0.033-0.065) |
| 10-day | **0.011** (0.010-0.013) | **0.013** (0.011-0.015) | **0.016** (0.013-0.019) | **0.018** (0.015-0.021) | **0.021** (0.017-0.026) | **0.024** (0.019-0.030) | **0.027** (0.021-0.034) | **0.029** (0.022-0.038) | **0.033** (0.024-0.044) | **0.036** (0.025-0.049) |
| 20-day | **0.007** (0.006-0.009) | **0.009** (0.007-0.010) | **0.010** (0.009-0.012) | **0.012** (0.010-0.014) | **0.014** (0.012-0.017) | **0.016** (0.013-0.019) | **0.017** (0.013-0.021) | **0.019** (0.014-0.024) | **0.021** (0.015-0.027) | **0.022** (0.016-0.030) |
| 30-day | **0.006** (0.005-0.007) | **0.007** (0.006-0.008) | **0.008** (0.007-0.010) | **0.010** (0.008-0.011) | **0.011** (0.009-0.013) | **0.012** (0.010-0.015) | **0.014** (0.011-0.017) | **0.015** (0.011-0.019) | **0.016** (0.012-0.021) | **0.017** (0.012-0.023) |
| 45-day | **0.005** (0.004-0.006) | **0.006** (0.005-0.006) | **0.007** (0.006-0.008) | **0.008** (0.007-0.009) | **0.009** (0.007-0.010) | **0.010** (0.008-0.012) | **0.011** (0.008-0.013) | **0.012** (0.009-0.015) | **0.013** (0.009-0.016) | **0.014** (0.010-0.018) |
| 60-day | **0.004** (0.004-0.005) | **0.005** (0.004-0.005) | **0.006** (0.005-0.007) | **0.007** (0.006-0.008) | **0.008** (0.006-0.009) | **0.008** (0.007-0.010) | **0.009** (0.007-0.011) | **0.010** (0.007-0.012) | **0.011** (0.008-0.014) | **0.011** (0.008-0.015) |

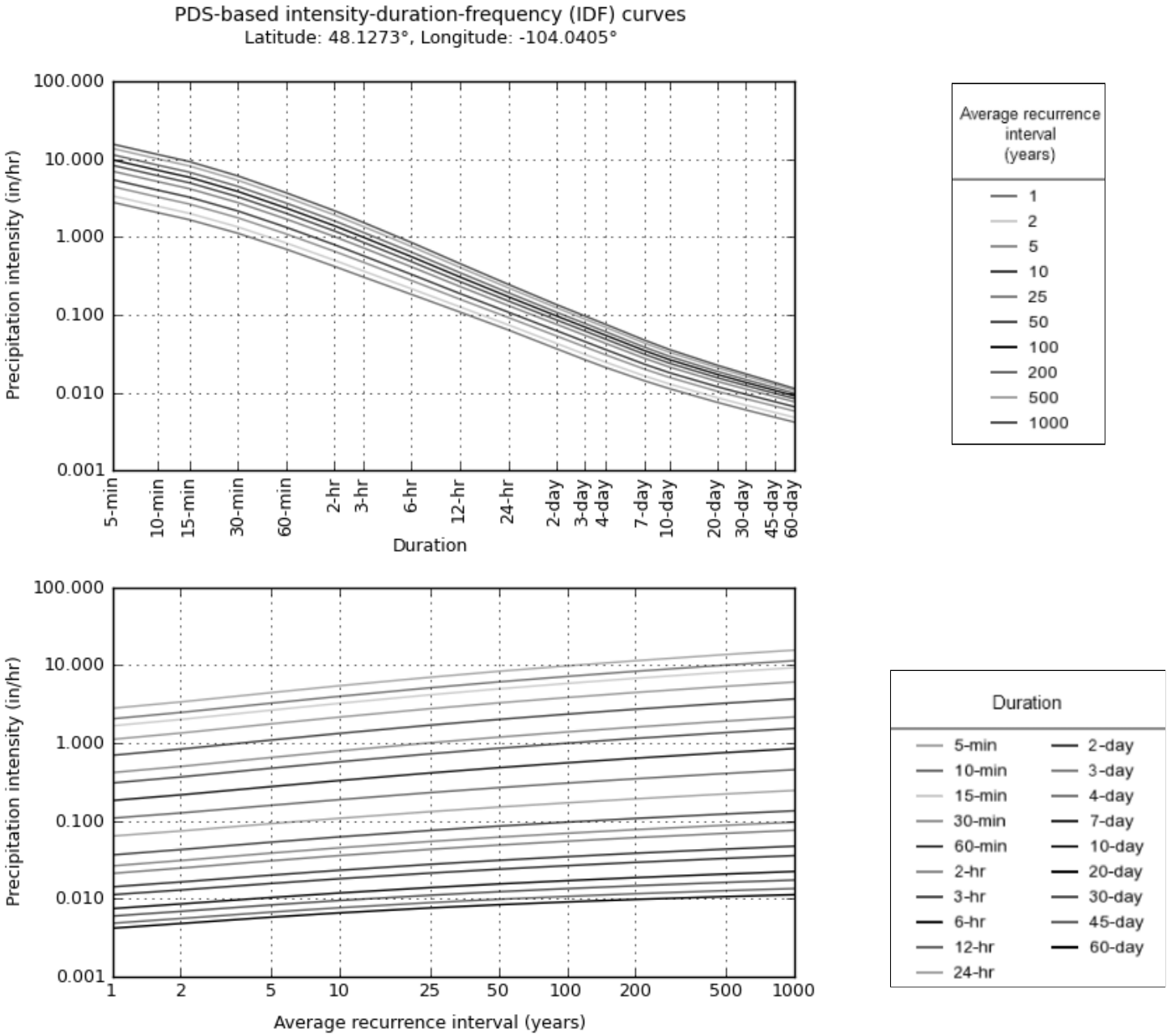
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Back to Top

## PF graphical



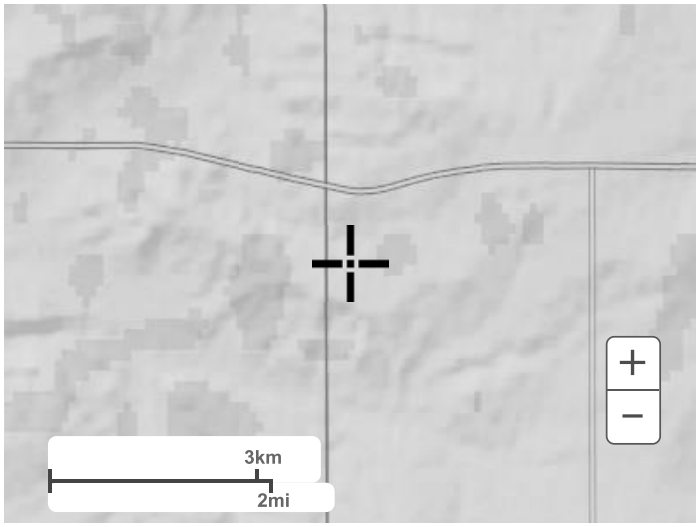

NOAA Atlas 14, Volume 8, Version 2

Created (GMT): Mon Feb 3 21:04:49 2020

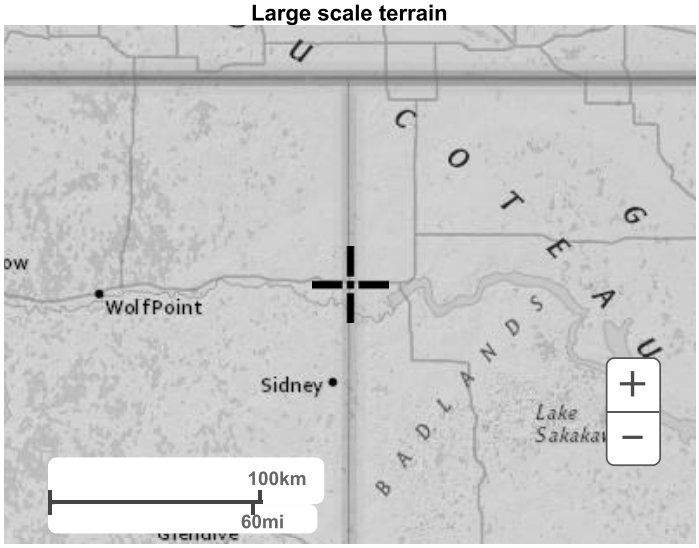
Back to Top

## Maps & aerials

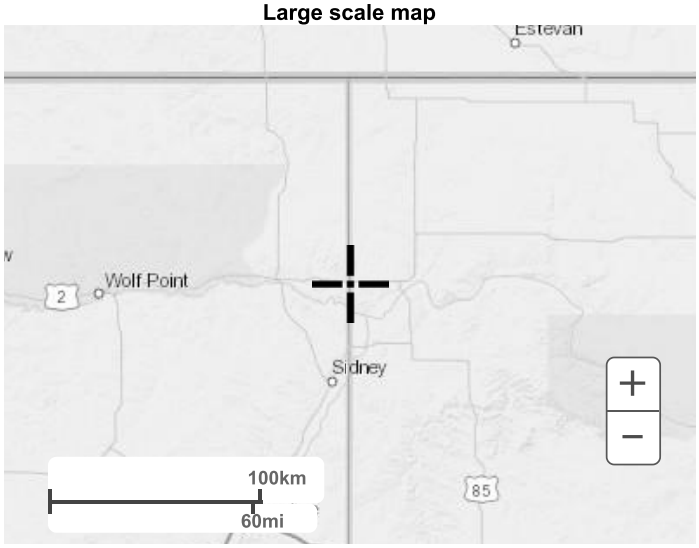
**Small scale terrain**



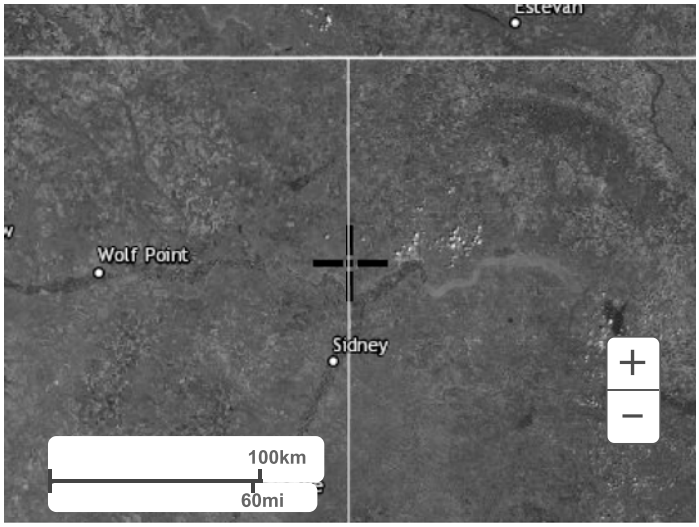

**Large scale terrain**




**Large scale map**




**Large scale aerial**




Back to Top

---

US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

# Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Feb 10 2020

## Spillway Channel

**Trapezoidal**

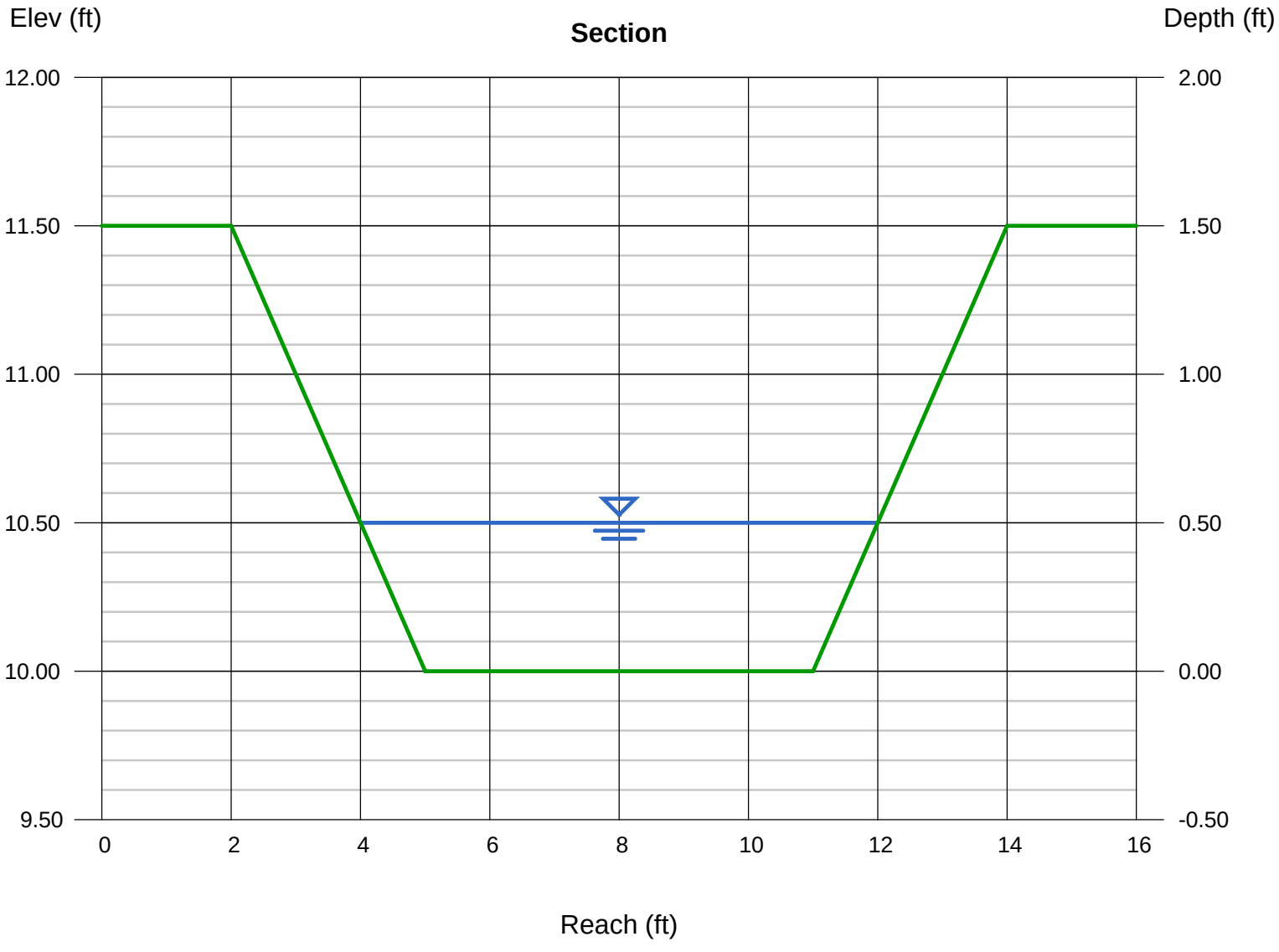
| | |
|---|---|
| Bottom Width (ft) | = 6.00 |
| Side Slopes (z:1) | = 2.00, 2.00 |
| Total Depth (ft) | = 1.50 |
| Invert Elev (ft) | = 10.00 |
| Slope (%) | = 33.00 |
| N-Value | = 0.050 |

**Calculations**

| | |
|---|---|
| Compute by: | Known Depth |
| Known Depth (ft) | = 0.50 |

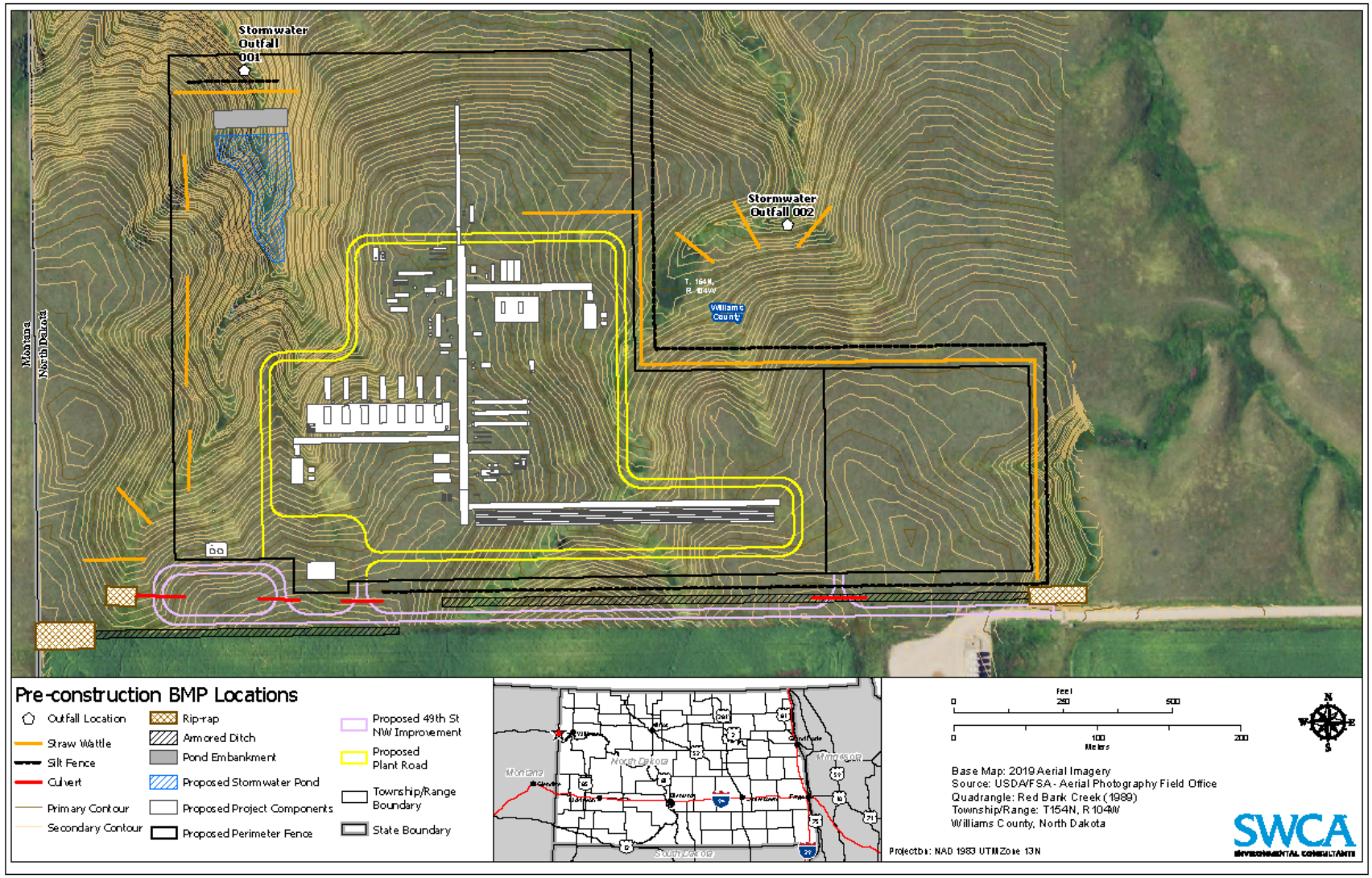
**Highlighted**

| | |
|---|---|
| Depth (ft) | = 0.50 |
| Q (cfs) | = 33.77 |
| Area (sqft) | = 3.50 |
| Velocity (ft/s) | = 9.65 |
| Wetted Perim (ft) | = 8.24 |
| Crit Depth, Yc (ft) | = 0.90 |
| Top Width (ft) | = 8.00 |
| EGL (ft) | = 1.95 |



# APPENDIX C

# BMP Location Maps




**Pre-construction BMP locations**

# APPENDIX D

# BMP Details and Construction Specifications

# TABLE OF CONTENTS

## 1. Berms

### *Description*

A berm is a ridge of compacted soil located at the top or base of a sloping disturbed area to contain or divert surface runoff. Berms may be constructed from either excavated topsoil or subsoil. The purpose of a berm is to control runoff velocity, divert onsite surface runoff to a sediment trapping device, and/or divert clean water away from disturbed areas.

### *Applicability*

Berms are usually appropriate for drainage basins smaller than five acres, but with modifications they can be capable of servicing areas as large as ten acres. With regular maintenance, earthen berms have a useful life span of approximately 18 months. Berms are applicable for the following applications:

- At the perimeter of a well pad (particularly the outer edge) to ensure that runoff remains on the pad and is diverted to a well pad detention pond, if available.
- Along the outside shoulder of an insloped road to ensure that runoff from the roadway drains inward and to protect the fill slope from continual disturbances during road blading and maintaining. See Grading Techniques (GT).
- Upslope of cut or fill slopes to divert flows away from disturbed areas.
- Downslope of cut or fill slopes to divert onsite runoff to a stabilized outlet or sediment trapping device, although diversions are more commonly used for this application. See Diversion (D).

### *Limitations*

- Berms may erode if not properly compacted and stabilized with vegetation or an erosion control blanket. Berms which are adjacent to concentrated flows will require erosion blanketing according to Erosion Control Blanket (ECB).
- If a berm crosses a vehicle roadway or entrance, its effectiveness can be reduced. Wherever possible, berms should be designed to avoid crossing vehicle pathways.

### *Design criteria*

No formal design is required.

### *Construction Specifications*

1. Prior to berm construction, remove all trees, brush, stumps and other objects in the path of the berm and till the base of the berm before laying the fill. Fill may consist of topsoil or subsoil excavated during the construction of nearby roads or well pads. If fill material is excavated adjacent to berm, following the specification for Diversion (D).
2. Construct the berm according to Figure 1 for the appropriate drainage area. For points where vehicles will cross the berm, the side slope should be no steeper than 3:1 and the mound may be constructed of gravel rather than soil. This will prolong the life of the berm and increase effectiveness at the point of vehicle crossing. For well pad perimeter installation the pad side of the berm should be sloped at 1.5:1 to help prevent vehicles from backing over the edge of the pad.
3. To remain effective, berms should be compacted with tracked equipment, if possible.
4. All berms shall have positive drainage to a stabilized outlet so that runoff does not collect in ponds on the upslope side of the berm, but instead flows along the berm until it reaches a stabilized outlet. Field location should be adjusted as needed. Stabilized outlet may be a well-vegetated area or a sediment control such as a silt fence or sediment trap where sediment can settle out of the runoff before being discharged to surface waters.
5. If the expected life span of the berm is greater than 15 days, it is strongly recommended that the berm be stabilized with vegetation or an erosion control blanket immediately after construction. Stabilization is required where concentrated flows are expected. See Table 1 for recommended stabilization methods for berms on various slopes.
6. Berms should be constructed and fully stabilized prior to commencement of major upslope land disturbance. This will maximize the effectiveness of the structure as a storm water control device.

### *Maintenance considerations*

The frequency of inspections should be in accordance with the Storm Water Management Plan (SWMP). Berms should be inspected for evidence of erosion or deterioration to ensure continued effectiveness. Berms should also be maintained at the original height. Any decrease in height due to settling or erosion, which impacts the effectiveness of the BMP, should be repaired immediately.

### *Removal*

Berms should remain in place and in good condition until all upslope disturbed areas are permanently stabilized. There is no need to formally remove the berm on completion of stabilization until interim or final reclamation.

### *References*

Environmental Protection Agency (EPA), National Pollutant Discharge Elimination System (NPDES). Construction Site Storm Water Runoff Control. Washington, D.C., February, 2003. <http://cfpub.epa.gov/npdes/stormwater/menuofbmps/con_site.cfm>

New York State Department of Environmental Conservation, New York Guidelines for Urban Erosion and Sediment Control. New York. Fourth Edition, 1997. http://www.dec.state.ny.us/website/dow/toolbox/escstandards

## Table 1: Temporary Berm Stabilization

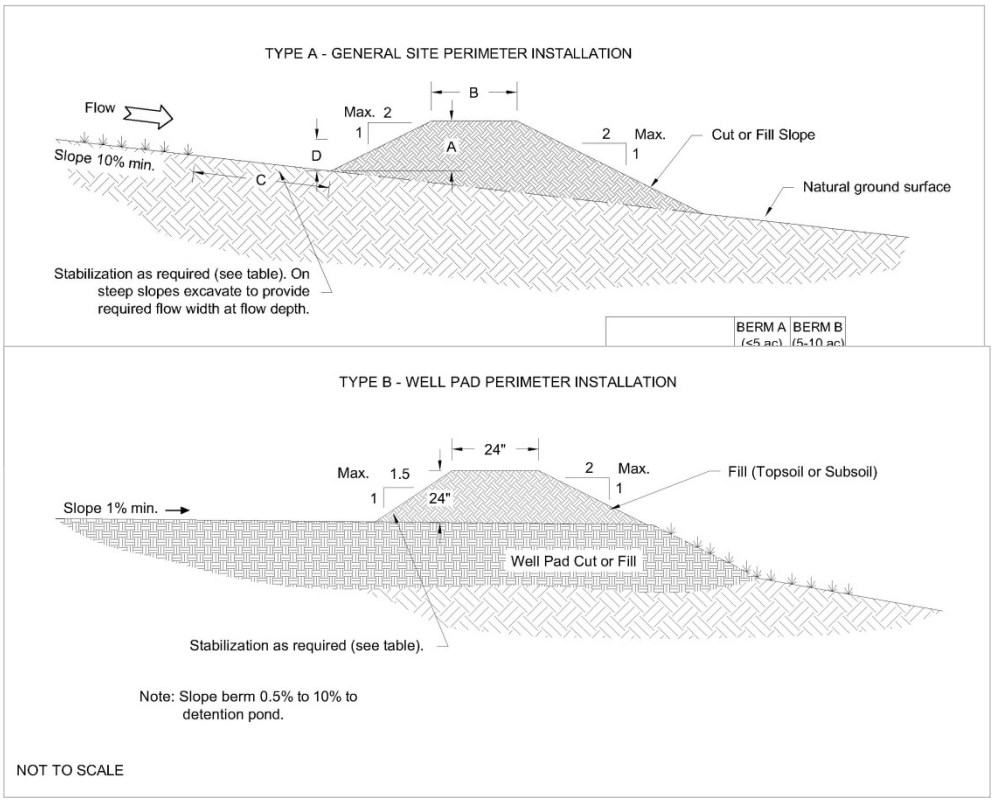
| Type of Treatment | Channel Grade[1] | A (<5 Ac.) | B (5-10 Ac) |
|---|---|---|---|
| 1 | 0.5-3.0% | Seed & Straw Mulch | Seed & Straw Mulch |
| 2 | 3.0-5.0% | Seed & Straw Mulch | Seed and cover with erosion control blanket, or lined with 2-inch stone |
| 3 | 5.0-8.0% | Seed and cover with erosion control blanket, or line with 2-inch stone | Line with 4 to 8-inch stone or rock[2] |
| 4 | 8.0-20.0% | Line with 4 to 8-inch or stone or rock[2] | Engineering Design |

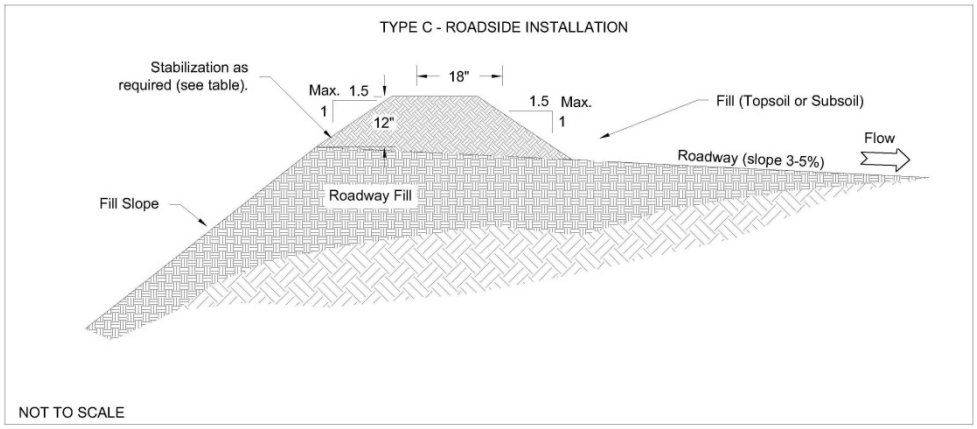
**Notes:**

[1] In highly erodible soils, as defined by the local approving agency, refer to the next higher slope grade for type of stabilization.

[2] Site rock if available, shall be broken into the required size.

**Figure 1: Berm Installation**



## 2. Diversion Ditches

### *Definition*

A diversion is a drainage way of parabolic or trapezoidal cross-section with a supporting ridge on the lower side that is constructed across the slope. The purpose of a diversion is to prevent off site storm runoff from entering a disturbed area, to prevent sediment laden storm runoff from leaving the construction site or disturbed area, to prevent flows from eroding slopes, and to direct sediment laden flows to a trapping device.

### *Applicability*

Diversions may be designed for temporary or permanent use. The maximum drainage area for temporary, un-compacted diversions is two acres. For drainage areas larger than two acres but less than ten acres, the diversion should be compacted. For undisturbed drainage areas larger than ten acres, a permanent diversion may be designed to handle larger flows. Diversions may be used for the following applications:

- Upslope of cut or fill slopes to convey or divert flows away from disturbed areas.
- Down slope of cut or fill slopes to divert onsite runoff to a stabilized outlet or sediment trapping device.
- At the outer edge of a well pad to ensure that runoff remains on the pad and is diverted to a well pad detention pond, if available.
- Where runoff from higher areas has potential for causing erosion, or interfering with, or preventing the establishment of, vegetation on lower areas.
- Where the length of slopes needs to be reduced so that soil loss will be kept to a minimum.
- At the perimeter of a site or disturbed area.

### *Limitations*

- The area around the diversion channel that is disturbed by its construction must be stabilized (with vegetation or other erosion control) so that it is not subject to similar erosion as the steep slope the channel is built to protect.
- To alleviate erosion capability, diversions must be directed into a stabilized outlet or well-vegetated area or to sediment trapping devices, where erosion sediment can settle out of the runoff before being discharged to surface waters.
- Temporary diversions should be designed to avoid crossing vehicle pathways.
- Diversions should be used with caution on soils subject to slippage.

### *Design criteria*

For a temporary diversion (drainage area less than 10 acres), no formal design is necessary. For permanent diversions (drainage area larger than 10 acres) the following guidelines apply:

- Location

Diversion location shall be determined by considering outlet conditions, topography, land use, soil type, length of slope, and the development layout.

- Capacity

Peak rates of runoff values used in determining the capacity requirements shall be as outlined by TR-55, Urban Hydrology for Small Watersheds. The constructed diversion shall have capacity to carry, as a minimum, the peak discharge from a ten-year frequency rainfall event with freeboard of not less than 0.3 feet.

- Cross section

See Figure 2 for details. The diversion channel shall be parabolic or trapezoidal in shape, if possible. The diversion shall be designed to have stable side slopes. The side slopes shall not be steeper than 2:1 and shall be flat enough to ensure ease of maintenance of the diversion and its protective vegetative cover. The ridge shall have a minimum width of four feet at the design water elevation; a minimum of 0.3 feet freeboard and a reasonable settlement factor (10%) shall be provided.

- Velocity and grade

The permissible velocity for the specific soil type will determine the maximum grade. The maximum permissible velocity for sand and silt vegetated channels is 3 ft/sec, and 5 ft/sec for clay vegetated channels. Diversions are not usually applicable below high sediment producing areas unless structural measures, designed to prevent damaging accumulations of sediment in the channels, are installed with, or before, the diversions.

### *Construction Specifications*

General

1. All trees, brush, stumps, obstructions, and other objectionable material shall be removed and disposed of so as not to interfere with the proper functioning of the diversion.
2. All diversions shall have uninterrupted positive grade to an outlet.
3. Each diversion must have an adequate outlet where outflow will not cause damage. Diverted runoff from a disturbed area shall be conveyed to a sediment trapping device. Diverted runoff from an undisturbed area shall outlet to a sediment trapping device or into an undisturbed stabilized area at non-erosive velocities. Vegetated outlets shall be installed before diversion construction, if needed, to ensure establishment of vegetative cover in the outlet channel.

Temporary diversion (drainage area <10 acres)

See Figure 2.

1. The diversion shall be excavated or shaped to line, grade, and cross section as required to meet the specified criteria. The diversion does not need to be compacted if the contributing drainage area is less than 2 acres.
2. Stabilization with vegetation is not required as long as sediment traps (see Sediment Trap [ST]) or other sediment control devices are provided.

Permanent diversion (drainage area >10 acres)

See Figure 2.

1. The diversion shall be excavated or shaped to line, grade, and cross section as required to meet the criteria specified herein, and be free of bank projections or other irregularities which will impede normal flow.

2. Parabolic and triangular-shaped, grass-lined channels should not have a top width of more than 30 feet. Trapezoidal, grass-lined channels may not have a bottom width of more than 15 feet unless there are multiple or divided waterways, they have a riprap center, or other methods of controlling the meandering of low flows are provided.
3. If grass-lined channels have a base flow, a stone center or subsurface drain or another method for managing the base flow must be provided.
4. Fills shall be compacted as needed to prevent unequal settlement that would cause damage in the complete diversion.
5. All earth removed and not needed in construction shall be spread or disposed of on the well pad side of the diversion so that it will not interfere with the functioning of the diversion.
6. Immediately after the ridge and channel are constructed, they must be seeded or hydro-seeded and mulched according to Re-vegetation (RV) and Mulching (M) along with any disturbed areas that drain into the diversion.
    a. For design velocities less than 3.5 ft/sec, seeding and mulching may be used for establishment of the vegetation. It is recommended that, when conditions permit, temporary diversions or other means should be used to prevent water from entering the diversion during the establishment of the vegetation.
    b. For design velocities or more than 3.5 ft/sec, the diversion shall be stabilized with seeding protected by Jute or Excelsior matting, or with seeding and mulching including temporary diversion of the water until the vegetation is established.

### *Maintenance considerations*

The frequency of inspections should be in accordance with the Storm Water Management Plan (SWMP). Channels should be cleared of sediment; repairs made when necessary, and seeded areas reseeded if a vegetative cover is not established. Maintain diversion capacity, ridge height, and outlet elevations especially if high sediment yielding areas are in the drainage area above the diversion. Establish necessary cleanout requirements. Redistribute sediment as necessary to maintain the capacity of the diversion.

### *Removal*

Temporary and un-compacted diversions shall remain in place only until the disturbed areas are permanently stabilized. Permanent diversions shall remain in place until final reclamation.

### *References*

Environmental Protection Agency (EPA), National Pollutant Discharge Elimination System (NPDES). Construction Site Storm Water Runoff Control. Washington, D.C., February, 2003. <http://cfpub.epa.gov/npdes/stormwater/menuofbmps/con_site.cfm>

New York State Department of Environmental Conservation, New York Guidelines for Urban Erosion and Sediment Control. New York. Fourth Edition, 1997. <http://www.dec.state.ny.us/website/dow/toolbox/escstandards>

United States Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS), Field Office Technical Guide. 2002. <www.nrcs.usda.gov/technical/efotg>

**Figure 2: Temporary Diversion Installation**

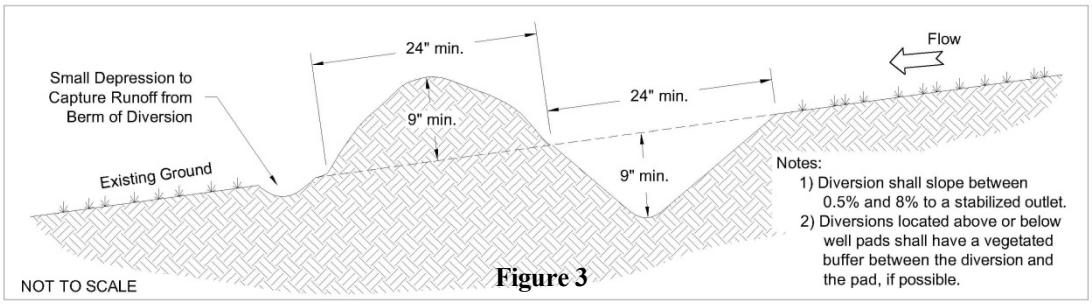
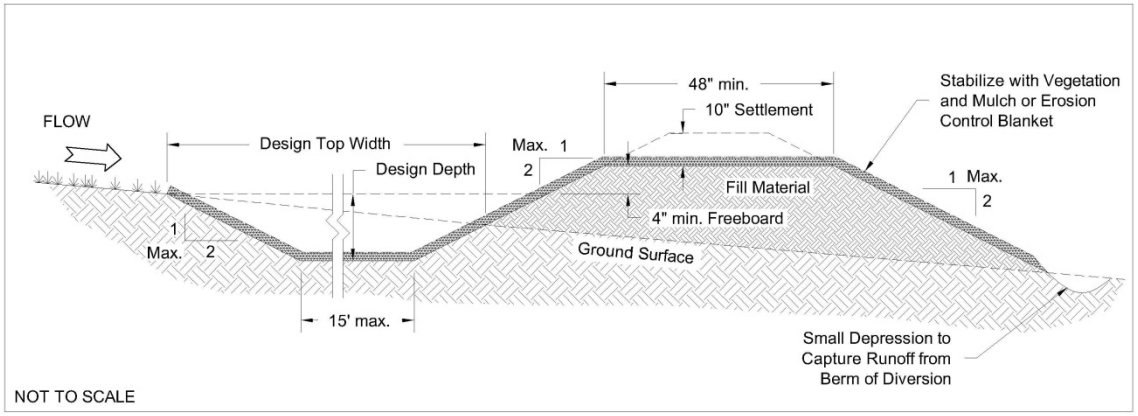



**Figure 3**

**Permanent Diversion Installation**



## 3. Erosion Control Blankets

### *Description*

Erosion control blankets are porous fabrics and are manufactured by weaving or bonding fibers made from organic or synthetic materials. Erosion control blankets are installed on steep slopes, over berms, or in channels to prevent erosion until final vegetation is established. However, blankets can also be used as separators or to aid in plant growth by holding seeds, fertilizers, and topsoil in place.

### *Applicability*

Erosion control blankets may be used in the following applications:

- To control erosion on steep slopes and to promote the establishment of vegetation.
- To stabilize channels against erosion from concentrated flows.
- To protect berms and diversions prior to the establishment of vegetation.
- To protect exposed soils immediately and temporarily, such as when active piles of soil are left overnight.
- As a separator between riprap and soil to prevent soil from being eroded from beneath the riprap and to maintain the riprap's base.
- May be used on slopes as steep as 1:1.
-

### *Limitations*

- Blankets used on slopes should be biodegradable, or photodegradable, non-toxic to vegetation or germination of seed, and non-toxic or injurious to humans.
- Should not be used on slopes where vegetation is already established.
- Some blankets might promote increased runoff and might blow away if not firmly anchored.
- If the fabric is not properly selected, designed, or installed, the effectiveness may be reduced drastically. Manufacturer’s specifications should be followed.

### *Design criteria*

There are many types of erosion control blankets available. Therefore, the selected fabric should match its purpose. Effective netting and matting require firm, continuous contact between the materials and the soil. If there is no contact, the material will not hold the soil, and erosion will occur underneath the material. Fabric should be purchased at an appropriate with to cover the whole width of the channel, if possible. Table 2 indicates some recommended criteria for the selection of erosion control blankets.

### *Construction specifications*

1. Smooth soil prior to installation and apply seed prior to fabric installation for stabilization of construction sites.
2. Select the appropriate fabric type. North American Green products are listed in Table 2. However, other products may also be used. Site specifics shall dictate blanket selection and use.
3. Select the appropriate seed mix according to the specification in Revegetation (RV).
4. Installation of the blankets shall be in accordance with the manufacturer's recommendations and according to Figure 4. For blankets being placed in channels, the fabric should be rolled out parallel to the channel if the width is sufficient to cover the entire width of the channel. The fabric needs to be in continuous contact with exposed soil.
5. Pins or staples shall be made of wire 0.162 inch or larger in diameter. "U" shaped staples shall have legs 8" long, and a 1" crown. "T" shaped pins shall have a minimum length of 8". The bar of the "T" shall be at least 4" long. Triangular survey stakes can also be used.

### *Maintenance considerations*

The frequency of inspections should be in accordance with the Storm Water Management Plan (SWMP). Inspections should determine if cracks, tears, or breaches have formed in the fabric. If the effectiveness of the BMP has been reduced, the fabric should be repaired or replaced immediately. Re-anchor loosened matting and replace missing matting and staples as required. It is necessary to maintain contact between the ground and the blanket at all times. Trapped sediment should be removed after each storm event.

### *References*


Environmental Protection Agency (EPA), National Pollutant Discharge Elimination System (NPDES). Construction Site Storm Water Runoff Control. Washington, D.C., February, 2003. http://cfpub.epa.gov/npdes/stormwater/menuofbmps/con_site.cfm

Horizon Environmental Services, Inc, Guidance Document Reasonable and Prudent Practices for Stabilization (RAPPS) of Oil and Gas Construction Sites. April 2004.

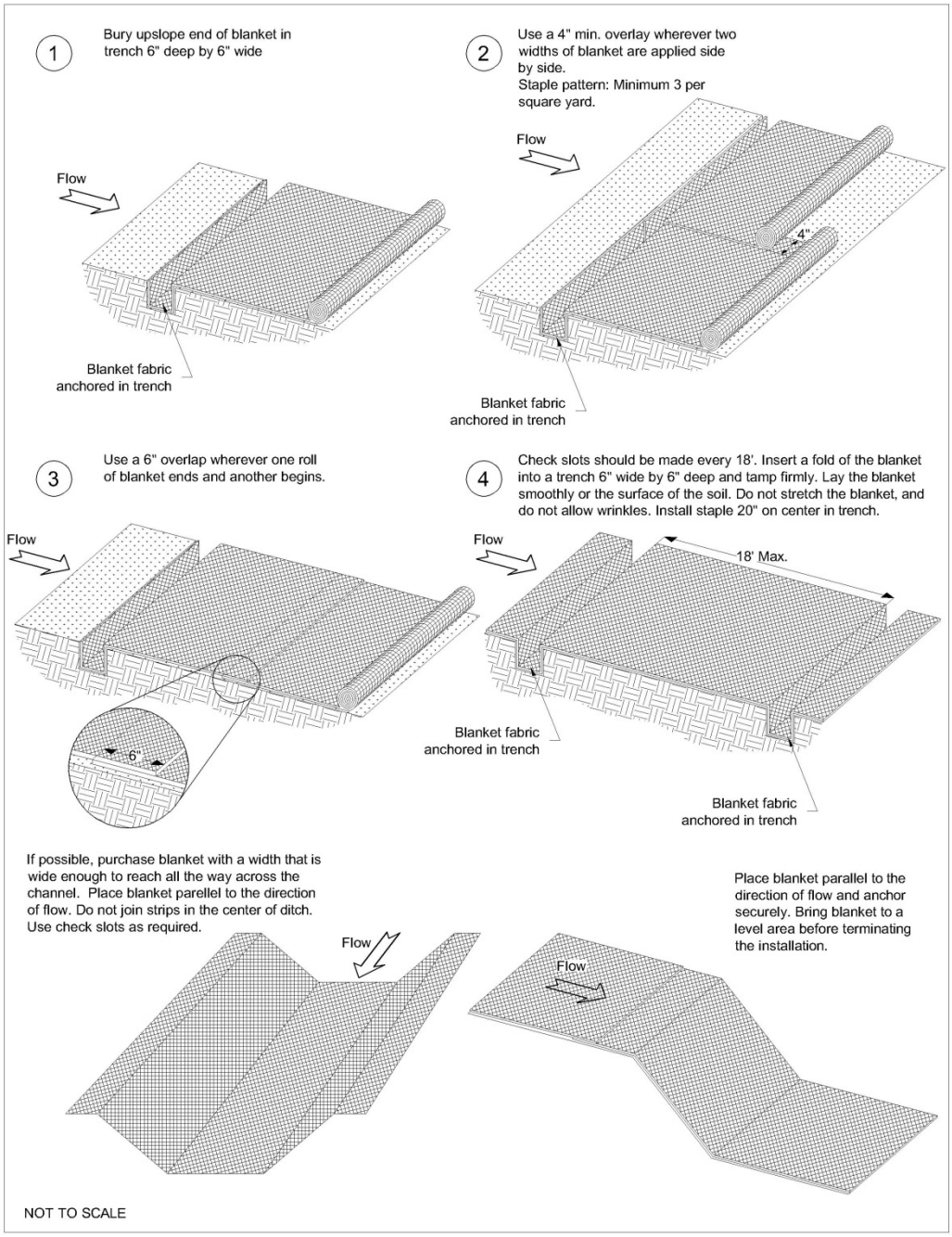
Keller, Gordon, and James Sherar, Low-Volume Roads Engineering, Best Management Practices Field Guide. United States Department of Agriculture (USDA), Forest Service, US Agency of International Development (USAID), 2005. http://www.blm.gov/bmp/field%20guide.htm

North American Green, 2004. <http://www.nagreen.com>

**Table 2: Suggested Blanket Types**

| Description (North American Green Product #) | Longevity | Applications | Max. Flow Velocity (feet/sec.) |
|---|---|---|---|
| Single Net Straw Blanket (S75) | 12 months | 4:1 - 3:1 Slopes<br>Low Flow Channels | 5 |
| Rapid Degrading Net (DS75) | 45 - 60 Days | | |
| Double Net Straw Blanket (S150) | 12 months | 3:1 - 2:1 Slopes<br>Moderate Flow Channels | 6 |
| Rapid Degrading Nets (DS150) | 45 - 60 Days | | |
| Double Net Blanket 70% Straw/30% Coconut (SC150) | 24 months | 2:1 - 1:1 Slopes<br>Medium Flow Channels | 8 |
| Double Net Blanket 100% Coconut (C125) | 36 months | 1:1 & Greater Slopes<br>High Flow Channels | 10 |
| Double Net Blanket Polypropylene Fiber (P300) | | 1:1 Slopes<br>Extended Flow Areas<br>High Flow Channels | 9 (unveg.)<br>16 (veg.) |
| Organic Net (S75BN) | 12 months | 4:1 - 3:1 Slopes<br>Low Flow Channels | 5 |
| Organic Net (S150BN) | 12 months | 3:1 - 2:1 Slopes<br>Moderate Flow Channels | 6 |
| Organic Net (SC150BN) | 18 months | 2:1 - 1:1 Slopes<br>Medium Flow Channels | 8 |
| Organic Net (C125BN) | 24 months | 1:1 & Greater Slopes<br>High Flow Channels | 10 |

**Figure 4: Erosion Control Blanket Installation**


1
Bury upslope end of blanket in trench 6" deep by 6" wide
Flow
Blanket fabric anchored in trench
2
Use a 4" min. overlay wherever two widths of blanket are applied side by side.
Staple pattern: Minimum 3 per square yard.
Flow
4"
Blanket fabric anchored in trench
3
Use a 6" overlap wherever one roll of blanket ends and another begins.
Flow
6"
4
Check slots should be made every 18'. Insert a fold of the blanket into a trench 6" wide by 6" deep and tamp firmly. Lay the blanket smoothly or the surface of the soil. Do not stretch the blanket, and do not allow wrinkles. Install staple 20" on center in trench.
Flow
18' Max.
Blanket fabric anchored in trench
Blanket fabric anchored in trench
If possible, purchase blanket with a width that is wide enough to reach all the way across the channel. Place blanket parellel to the direction of flow. Do not join strips in the center of ditch. Use check slots as required.
Flow
Place blanket parallel to the direction of flow and anchor securely. Bring blanket to a level area before terminating the installation.
Flow
NOT TO SCALE

## 4. Grading Techniques

### *Description*

Grading involves reshaping the ground surface to planned grades as determined by an engineering survey, evaluation, and layout. Grading provides more suitable topography for well pads and pipelines and helps to control surface runoff, soil erosion, and sedimentation during and after construction in these areas. This BMP shall include the following:

- Proper cut and fill techniques to ensure road and well pads remains stable over time.
- Road crowning or sloping to properly route runoff off the roadway.
- Surfacing with gravel to avoid mud, rutting, and large quantities of sediment that will wash away during storms.
- Surface roughening to reduce runoff velocity and erosion, trap sediment, and prepare the soil for seeding and planting.

### *Applicability*

- This BMP is applicable to the construction and maintenance of any road or well pad, but particularly those located on steep topography or easily erodible soils.
- Gravel surfacing is applicable to all roads or pads with "soft" sections, steep grades, highly erosive soils, or where all-weather access is needed. Gravel may be used as "fill" material in ruts or as a full structural section over the entire road or pad.
- Soil roughening is most effective for areas of one acre or less, and works well for any slope (but particularly fill slopes greater than 3:1), areas with highly erodible soils, and for soils that are frequently disturbed.

### *Limitations*

- Improper cut and fill slopes that disrupt natural storm water patterns might lead to poor drainage, high runoff velocities, and increased peak flows during storm events.
- Rutting and wash boarding may develop if surface gravel is not designed properly or if road is not sloped.
- Flat-blading to maintain the roadway must be done properly to avoid changes in gravel thickness, road slope, and road grade.
- Soil roughening is not appropriate for rocky slopes, and is likely to be ineffective in for anything more than a gentle or shallow depth rain. If roughening is washed away in a heavy storm, the surface will have to be re-roughened and new seed planted.

### *Design criteria*

- Grading plan

A grading plan should be prepared that establishes the extent to which the road or pad will be graded, how drainage patterns will be directed, and how runoff velocities will affect receiving waters. The grading plan also includes information regarding when earthwork will start and stop, establishes the degree and length of finished slopes, and dictates where and how excess material will be disposed of (or where borrow materials will be obtained if needed). Practices must be developed for erosion control, slope stabilization, and safe disposal of runoff water and drainage, such as ditches and culverts, grade stabilization structures, retaining walls, and surface drains. Berms, roadside ditches, and other storm water practices that require excavation and filling also should be incorporated into the grading plan.

Land grading should be based upon pad and pipeline layouts that fit and utilize existing topography and desirable natural surroundings to avoid extreme grade modifications. Clearing and grading should only occur at those areas necessary for pad activities and equipment traffic. Maintaining undisturbed temporary or permanent buffer zones in the grading operation provides a low-cost sediment control measure that will help reduce runoff and off-site sedimentation.

- Slope failures

Landslides and failed cuts and fills can be a major source of sediment, they can close the road or require major repairs, and they can greatly increase maintenance costs. Slope failures, or landslides, typically occur where a slope is over-steep, where fill material is not compacted, or where cuts in natural soils encounter groundwater or zones of weak material. Good road location can often avoid landslide areas and reduce slope failures. When failures do occur, the slide area should be stabilized by removing the slide material, flattening the slope, adding drainage, or using structures, as discussed below. Designs are typically site specific and may require input from geotechnical engineers and engineering geologists. Failures that occur typically impact road operations and can be costly to repair. Failures near streams and channel crossings have an added risk of impact to water quality.

- Road slope

See Figure 5. All roads should be designed with one of the following three slope types:

Outsloped roads minimize the concentration of water and minimize road width by avoiding the need for an inside ditch, but may require roadway surface and fill slope stabilization. Outsloped roads with clay rich, slippery road surface materials often require surface stabilization with gravel or limited use during rainy periods to assure traffic safety. On road grades over 10 to 12 percent and on steep hill slope areas, outsloped roads are difficult to drain and can feel unsafe.

Insloped roads are the best method to control surface water. However, insloped roads also concentrate water and require a system of ditches and turnouts or cross-draining culverts.

Crowned roads are appropriate for higher standard, two lane roads on gentle grades. They may or may not require roadside ditches, turnouts, and/or cross-drains. It is difficult to create and maintain a crown on a narrow road, so generally insloped or outsloped road drainage is more effective.

### *Construction Specifications*

Cut and fill slopes

1. All applicable perimeter erosion and sediment control practices and measures (berms, diversions, wattles, etc.) shall be constructed prior to any grading activities, and maintained in accordance with this BMP and the SWMP. Perimeter controls should remain in place until all graded or disturbed areas, including slopes, are adequately stabilized.
2. All areas to be disturbed (both cut and fill) shall be cleared, grubbed, and stripped of topsoil to remove trees, vegetation, roots, or other objectionable material.
3. Fill material shall be free of brush, logs, stumps, roots, or other objectionable materials that would interfere with, or prevent, construction of satisfactory fills. This material can be set aside and later used at the toe of fill slopes as filter berms. Frozen material shall not be placed in the fill nor shall the fill material be placed on a frozen foundation.
4. Table 5 presents a range of commonly used cut and fill slope ratios appropriate for the soil and rock types described. Figures 6 and 7 present typical cut slope and fill slope design options for varying slope and site conditions. Vertical cut slopes should not be used unless the cut is in rock or very well cemented soil. Ideally, both cut and fill slopes should be constructed with a 2:1 or flatter slope to promote growth of vegetation, but cut slopes in dense, sterile soils or rocky material are often difficult to vegetate.
5. All fills shall be compacted as required to reduce erosion, slippage, settlement, subsidence, or other related problems.
6. Topsoil required for the establishment of vegetation shall be stockpiled in the amount necessary to complete finished grading of all exposed areas. Areas that are to be topsoiled shall be scarified to a minimum depth of four inches prior to placement of topsoil.
7. All graded cut and fill areas shall be stabilized, either structurally or vegetatively, immediately following finished grading. Some common slope stabilization options appropriate for roads include hydroseeding, hydromulching, erosion control blankets, riprap, and retaining walls.

Road slope

1. See Figure 5, Figure 6, and Figure 7. Compact soil or road base material to direct runoff.
2. If crowning a road, runoff is directed to both sides of the road requiring two roadside ditches, unless runoff will drain directly to well-stabilized areas.
3. If using an inslope design, runoff is directed toward the hillside and requires a roadside ditch with periodic turnouts or cross drain culvert installation.
4. If using an outslope design, ensure a moderate road slope with dense vegetative cover.

Surface gravel

1. Gradation of gravel should be according to Figure 8. This figure shows the typical gradation ranges of aggregates used in road construction, how the materials, ranging from coarse to fine, best perform for a road, and the approximate limitations to the desirable gradation ranges. Ideally, aggregate surfacing material is (1) hard, durable, and crushed or screened to a minus 2 inch size; (2) well graded to achieve maximum density; (3) contains 5-15% clayey binder to prevent raveling; and (4) has a Plasticity Index of 2 to 10.
2. Gravel should be placed to a thickness of at least twice the diameter of the largest stone with a minimum thickness of four inches. Over very weak soils gravel thickness can be reduced with the use of geotextile or geogrid subgrade reinforcement. Also, geotextile

layers are useful over soft soils to separate the gravel from the soil, keep it uncontaminated, and extend the useful life of the gravel.

3. Compact the aggregate during construction and maintenance to achieve a dense, smooth road surface and thus reduce the amount of water that can soak into the road.
4. "Spot" stabilize local wet areas and soft areas with four to six inches of coarse rocky material. Add more rock as needed.
5. Blend coarse aggregate and fine clay-rich soil (when available) to produce a desirable composite roadway material that is coarse yet well-graded with 5-15 % fines for binder.
6.

Surface roughening

1. To slow erosion, surface roughening (by either corrugating or tracking) should be done as soon as possible after grading activities have ceased (temporarily or permanently) in an area. All cut and fill slopes should be roughened wherever possible. Do not blade or scrape the final fill slope face. Excessive compacting of the soil surface should be avoided during roughening, and areas should be seeded as quickly as possible after roughening is complete. Compact the aggregate during construction and maintenance to achieve a dense, smooth road surface and thus reduce the amount of water that can soak into the road.
2. Corrugating (Figure 9) uses machinery to create a series of ridges and depressions that run across the slope on the contour. Groove using any appropriate implement that can be safely operated on the slope, such as disks, tillers, spring harrows, or the teeth of a front-end loader bucket. Do not make the grooves less than 3 inches deep or more than 15 inches apart.
3. Tracking (Figure 10) is the most common method of soil roughening and is sometimes used as a method to hold down mulch. However, tracking is generally not as effective as corrugating. Tracking should be used primarily in sandy soils to avoid undue compaction of the soil surface. Operate tracked machinery up and down the slope to leave horizontal depressions in the soil. Do not back-blade during the final grading operation.

### *Maintenance considerations*

The frequency of inspections should be in accordance with the Storm Water Management Plan (SWMP). Inspect cut and fill slopes for rills or other indications of erosion. Maintain all crowns, outslopes, inslopes, and surface gravel.

The road surface and shoulders should be periodically smoothed and reshaped with a grader blade (flat-blading). This should be done when the gravel is moist. Maintain the proper road slope and grade while flat-blading. Also be sure to avoid plugging roadside ditches or altering adjacent drainage structures, as this may cause them to not function properly. Flat-blading may also cause road gravel to be pushed off the main roadway and onto the shoulders. To avoid this blade toward the center of the road.

Roughening might need to be repeated after storm events. Inspections of roughened slopes will indicate where additional erosion and sediment control measures are needed. If rills appear, they should be filled, graded again, and reseeded as soon as possible. Proper dust control methods should be used.

## *References*


Environmental Protection Agency (EPA), National Pollutant Discharge Elimination System (NPDES). Construction Site Storm Water Runoff Control. Washington, D.C., February, 2003. http://cfpub.epa.gov/npdes/stormwater/menuofbmps/con_site.cfm

Horizon Environmental Services, Inc, Guidance Document Reasonable and Prudent Practices for Stabilization (RAPPS) of Oil and Gas Construction Sites. April 2004.

Keller, Gordon, and James Sherar, Low-Volume Roads Engineering, Best Management Practices Field Guide. United States Department of Agriculture (USDA), Forest Service, US Agency of International Development (USAID), 2005. http://www.blm.gov/bmp/field%20guide.htm

New York State Department of Environmental Conservation, New York Guidelines for Urban Erosion and Sediment Control. New York. Fourth Edition, 1997. http://www.dec.state.ny.us/website/dow/toolbox/escstandards

United States Department of the Interior and United States Department of Agriculture. Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development "Gold Book". BLM/WO/ST-06/021+3071. Bureau of Land Management (BLM). Denver, Colorado. Fourth Edition, 2006.

**Table 3: Stable Slope Ratios for Various Conditions**

| Soil/Rock Condition | Slope Ratio (Hor:Vert) |
|---|---|
| Most rock | ¼:1 to ½:1 |
| Very well cemented soils | ¼:1 to ½:1 |
| Most in-place soils | ¾:1 to 1:1 |
| Very fractured rock | 1:1 to 1 ½: 1 |
| Loose coarse granular soils | 1 ½: 1 |
| Heavy clay soils | 2:1 to 3:1 |
| Soft clay rich zones or wet seepage areas | 2:1 to 3:1 |
| Fills of most soils | 1 ½:1 to 2:1 |
| Fills of hard, angular rock | 1 1/3 :1 |
| Low cuts and fills (<10 ft high) | 2:1 or flatter (for revegetation) |

**Figure 5: Typical Road Surface Drainage Options**

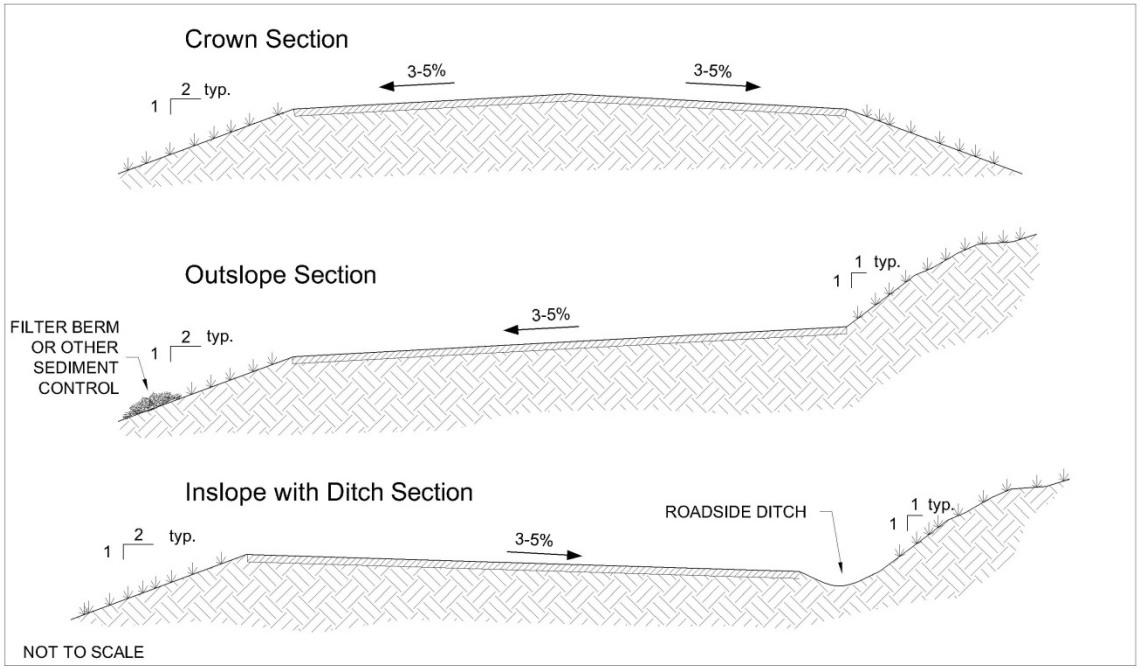



**Figure 6: Cut Slope Design Options**

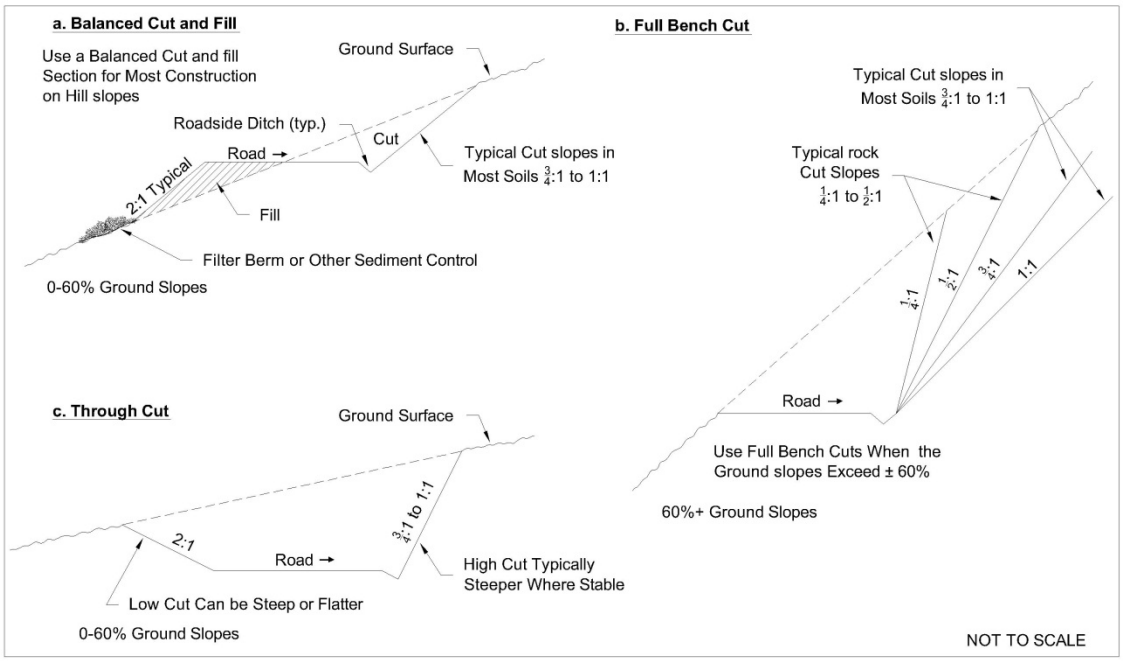


**Figure 7: Fill Slope Design Options**

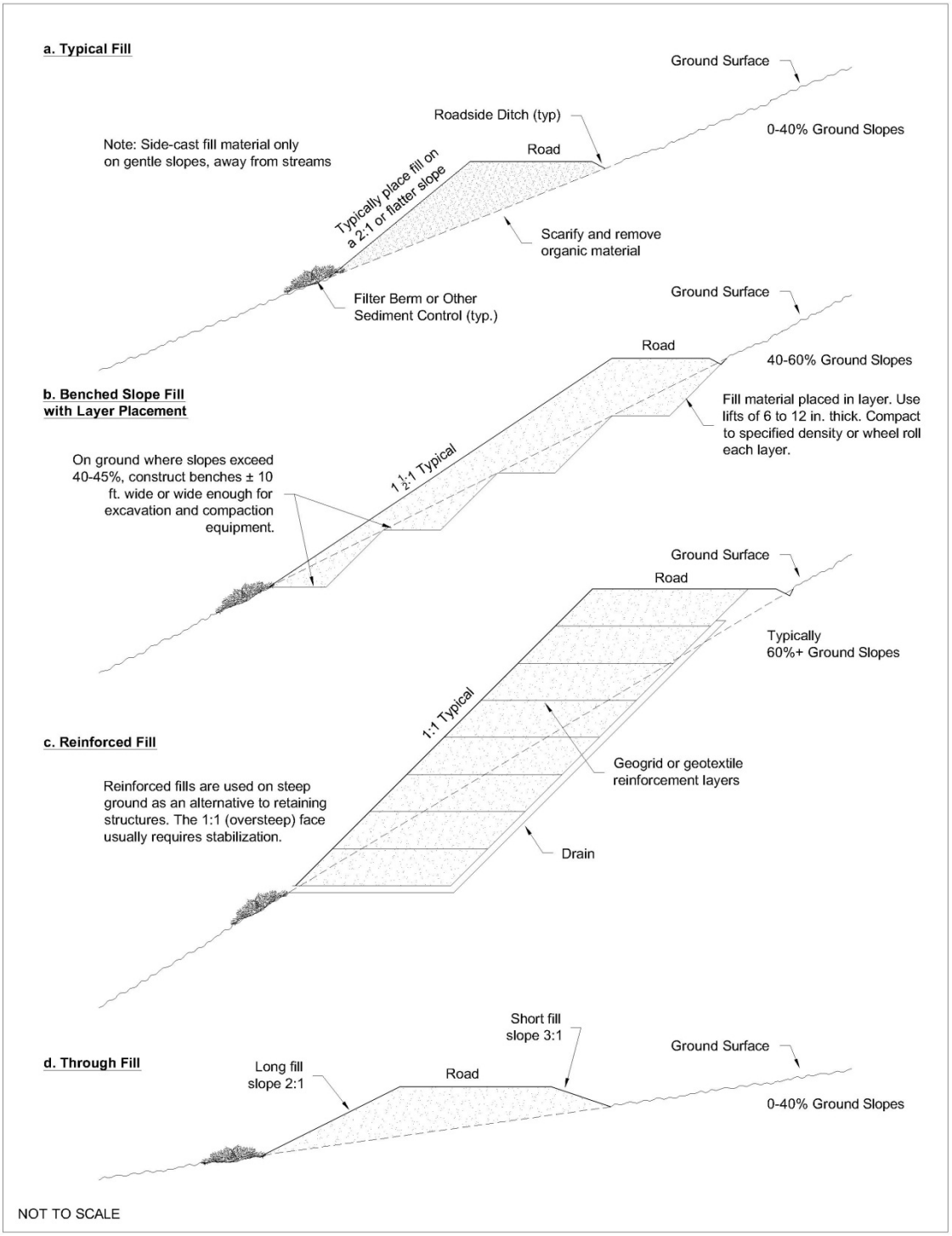
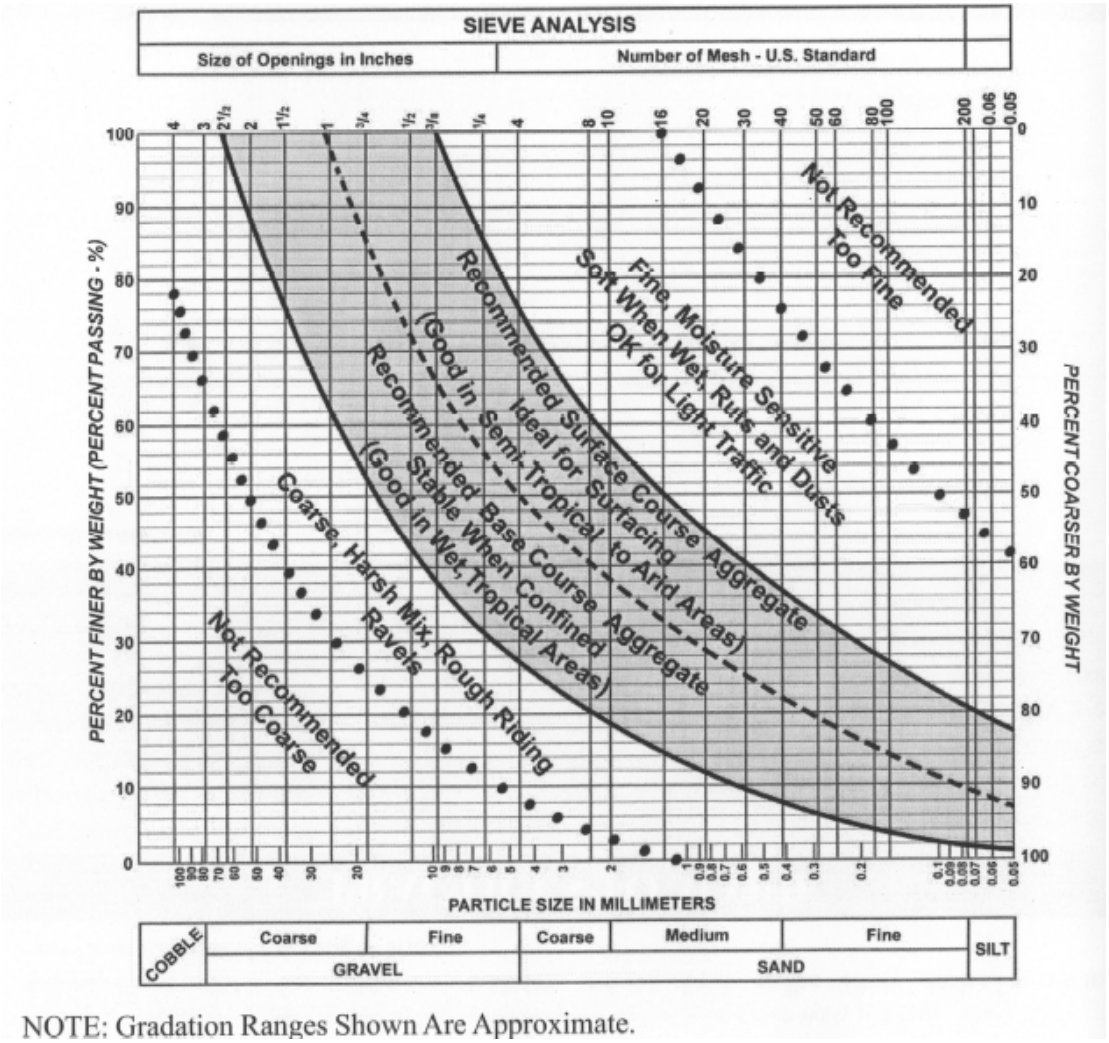


**Figure 8: Gradation and Performance of Roadway Surfacing Materials**




NOTE: Gradation Ranges Shown Are Approximate.

**Figure 9: Corrugating**

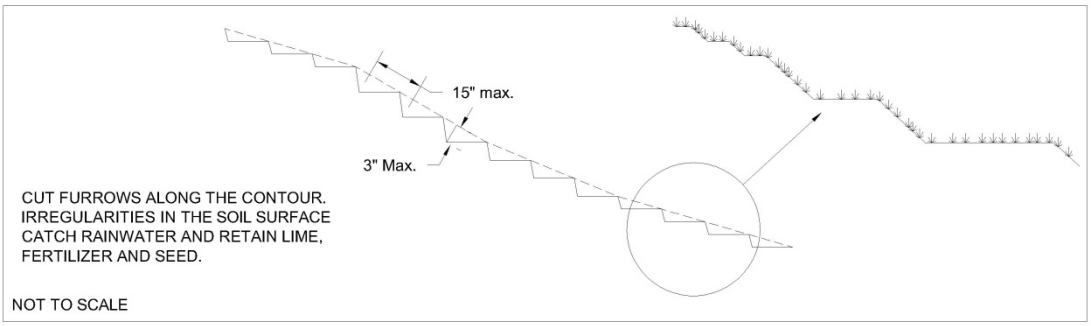
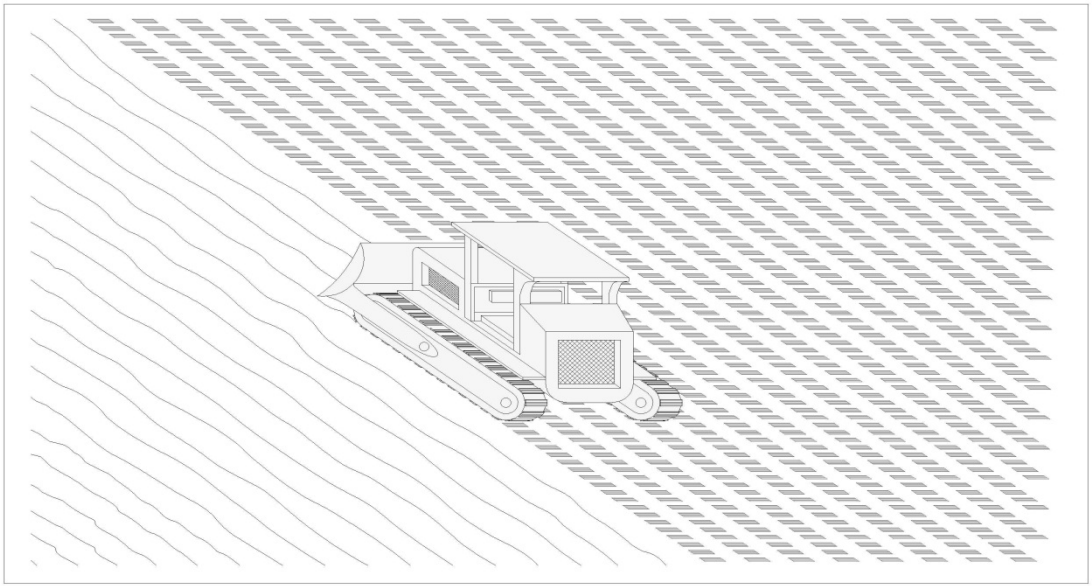



**Figure 10: Tracking**



## 5. Mulching

### *Description*

Mulching is a temporary erosion control practice in which materials such as grass, hay, wood chips, wood fibers, straw, or gravel are placed on exposed or recently planted soil surfaces. Mulching stabilizes soils by minimizing rainfall impact and reducing storm water runoff velocity. When used in combination with seeding or planting, mulching can aid plant growth by holding seeds, fertilizers, and topsoil in place, preventing birds from eating seeds, retaining moisture, and insulating plant roots against extreme temperatures.

Mulch mattings are materials such as jute or other wood fibers that are formed into sheets and are more stable than loose mulch. Jute and other wood fibers, plastic, paper, or cotton can be used individually or combined into mats to hold mulch to the ground. Netting can be used to stabilize soils while plants are growing, although netting does not retain moisture or insulate against extreme temperatures. Mulch binders consist of asphalt or synthetic materials that are sometimes used instead of netting to bind loose mulches.

Hydraulic mulching is a temporary erosion control practice in which materials such as grass, hay, wood chips, wood fibers, straw, or gravel are hydraulically applied to exposed or recently planted soil surfaces. Hydraulic application of mulch (as well as seed) can be done quickly and efficiently with the correct equipment and ingredients.

### *Applicability*

Mulching is often used in areas where temporary seeding cannot be used because of environmental constraints. On steep slopes and critical areas such as waterways, mulch matting is used with netting or anchoring to hold it in place. Mulches can be used on seeded and planted areas where slopes are steeper than 2:1 or where sensitive seedlings require insulation from extreme temperatures or moisture retention. Hydraulic mulching is often used in steep areas where regular mulching is difficult because of environmental constraints. Hydraulic mulches can be used on seeded and planted areas where slopes are as steep as 1:1. Mulch is most effective when used on an area less than two acres in size and can last for one to two years.

### *Limitations*

Mulching, matting, and netting might delay seed germination because the cover changes soil surface temperatures.

The mulches themselves are subject to erosion and may be washed away in a large storm.

Maintenance is necessary to ensure that mulches provide effective erosion control.

Hydraulic application of mulch must be done when no rainfall is expected, preferably within a 24-hour time period.

### *Design criteria*

No formal design is required.

### *Construction Specifications*

1. Site preparation:
   a. Prior to mulching, install the necessary temporary or permanent erosion control practices and drainage systems within or adjacent to the area to be mulched.
   b. Slope, grade, and smooth the site to fit needs of selected mulch products.
   c. Remove all undesirable stones and other debris to meet the needs of the anticipated land use and maintenance required.
2. Mulching & anchoring for relatively flat slopes:
   a. Select the appropriate mulch and application rate that will best meet the need and availability of material. When possible, organic mulches should be used for erosion control and plant material establishment. See Table 4a for suggested materials and application rates. Other materials include hydraulic mulch products with 100-percent post-consumer paper content and yard trimming composts. All materials should be free of seed.
   b. Apply mulch after soil amendments and planting is accomplished or simultaneously if hydroseeding is used. See Table 4b for installation guidelines.
   c. Use a mulch crimper to apply and anchor mulch. Crimper should have approximately 6-inch cleats with perpendicular, dull, disc blades. If a crimper is unavailable the Contractor shall apply mulch and anchor it to the soil using one of the methods described in Table 4b. The mulch should be anchored the same day as mulch application. Materials that are heavy enough to stay in place (for example, bark or wood chips on flat slopes) do not need anchoring. Mulches may or may not require a binder, netting, or tacking. Mulch binders should be applied at rates recommended by the manufacturer. Effective use of netting and matting material requires firm, continuous contact between the materials and the soil.
3. Hydraulic mulching for steeper slopes:
   a. The mulch shall be a hydraulically-applied, flexible erosion control blanket composed of long strand, thermally refined wood fibers, crimped, interlocking fibers, and performance enhancing additives. The hydraulic mulch shall require no curing time period and upon application shall form an intimate bond with the soil surface to create a continuous, porous, absorbent and erosion resistant blanket that allows for rapid germination and accelerated plant growth.

### *Maintenance considerations*

The frequency of inspections should be in accordance with the Storm Water Management Plan (SWMP). Areas should be identified where mulch has loosened or been removed. Such areas should be reseeded (if necessary) and the mulch cover replaced. If washout, breakage, or erosion occurs, surfaces should be repaired, reseeded, and re-mulched, and new netting should be installed. Inspections should be continued until vegetation is firmly established.

### *Removal*

Anchor netting and any other artificial mulch material should be removed when protection is no longer needed and disposed of in a landfill.

### *References*


Environmental Protection Agency (EPA), National Pollutant Discharge Elimination System (NPDES). Construction Site Storm Water Runoff Control. Washington, D.C., February, 2003. http://cfpub.epa.gov/npdes/stormwater/menuofbmps/con_site.cfm

Horizon Environmental Services, Inc, Guidance Document Reasonable and Prudent Practices for Stabilization (RAPPS) of Oil and Gas Construction Sites. April 2004.

United States Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS), Field Office Technical Guide. 2002. www.nrcs.usda.gov/technical/efotg


**Table 4a: Typical Mulching Materials and Application Rates**

| Material | Rate per Acre | Requirements | Notes |
|---|---|---|---|
| **Organic Mulches** | | | |
| Straw | 1 - 2 tons | Dry, unchopped, unweathered; certified weed free. | Spread by hand or machine; must be tacked or tied down. |
| Wood fiber or wood cellulose | ½ - 1 ton | | Use with hydroseeder; may be used to tack straw. Do not use in hot, dry weather. |
| Wood chips | 5 - 6 tons | Air dry. Add fertilizer N, 12 lb/ton. | Apply with blower, chip handler, or by hand. Not for fine turf areas. |
| Bark | 35 $yd^3$ | Air dry, shredded, or hammermilled, or chips | Apply with mulch blower, chip handler, or by hand. Do not use asphalt tack. |
| **Nets and Mats** | | | |
| Jute net | Cover area | Heavy, uniform; woven of single jute yarn. Used with organic mulch. | Withstands water flow. |
| Excelsior (wood fiber) mat | Cover area | | |

**Table 4b: Mulch Anchoring Guide**

| Anchoring Method or Material | Kind of Mulch to be Anchored | How to Apply |
|---|---|---|
| 1. Mulch netting | Hay or straw | Staple the light-weight paper, jute, wood fiber, or plastic nettings to soil surface according to manufacturer's recommendations. Should be biodegradable. Most products are not suitable for foot traffic. |
| 2. Wood cellulose fiber | Hay or straw | Apply hydroseeder immediately after mulching. Use 500 lbs. Wood fiber per acre. Some products contain an adhesive material, possibly advantageous. |
| 3. Mulch anchoring tool/Crimper | Hay or straw | Apply mulch and pull a mulch anchoring tool (blunt, straight discs) over mulch as near to the contour as possible. Mulch material should be "tucked" into soil surface about 3". |
| 4. Chemical | Hay or straw | Apply Terra Tack AR 120 lbs./ac. In 480 gal. of water (#156/ac.) or Aerospray 70 (60 gal/ac.) according to manufacturer's instructions. Avoid application during rain. A 24-hour curing period and a soil temperature higher than 45 deg. Fahrenheit are required. |

## 6. Re-vegetation

### *Description*

Re-vegetation involves planting seed to establish a vegetative cover on disturbed areas. Re-vegetation reduces erosion and sedimentation by stabilizing disturbed areas in a manner that is economical, adaptable to site conditions, and allows selection of the most appropriate plant materials. Re-vegetation also:

- Absorbs the impact of raindrops
- Reduces the velocity of runoff
- Reduces runoff volumes by increasing water percolation into the soil
- Binds soil with roots
- Protects soil from wind
- Improves wildlife habitat
- Enhances natural beauty

### *Applicability*

Re-vegetation is most effective on slopes no steeper than 2:1 and may be used in areas where exposed soil surfaces are not to be re-graded for periods longer than 30 days. Such areas include denuded areas, soil stockpiles, berms, temporary road banks, etc.

### *Limitations*

The effectiveness of re-vegetation can be limited due to the following:

- High erosion potential during establishment.
- The need for stable soil temperature and soil moisture content during germination and early growth.
- The need to reseed areas that fail to establish.

Proper seedbed preparation and the use of quality seed are important in this practice. Failure to carefully follow sound agronomic recommendations will often result in an inadequate stand of vegetation that provides little or no erosion control.

Seeding does not immediately stabilize soils. Prior to seeding, install necessary erosion and sediment control practices such as diversions, straw bales, and basins until vegetation is established.

### *Design criteria*

1. Successful plant establishment can be maximized with proper planning; consideration of soil characteristics; selection of plant materials that are suitable for the site; adequate seedbed preparation, liming, and fertilization; timely planting; and regular maintenance.
2. Coordinate installation of seeding materials during normal planting seasons for each type of seed material required.
3. Seeding in areas that are non-irrigated or not provided with sprinkling or watering systems shall be restricted according to the following schedule:
    a. Below 6000' elevation: Spring seeding shall occur between spring thaw and July 1st. Fall seeding shall occur from September 1st until consistent ground freeze.
    b. 6000' to 7000' elevation: Spring seeding shall occur between spring thaw and July 1st. Fall seeding shall occur from August 15th until consistent ground freeze.
    c. 7000' to 8000' elevation: Spring seeding shall occur between spring thaw and July 15th. Fall seeding shall occur from August 1st until consistent ground freeze.
    d. Above 8000' elevation: Seeding shall occur from spring thaw until consistent ground freeze.
    e. Spring thaw shall be defined as the earliest date in a calendar year in which seed can be buried ½ inch into the topsoil thru normal drill seeding methods.
    f. Consistent ground freeze shall be defined as that time during fall months in which the topsoil, due to freeze conditions, prevents burying seed ½ inch thru normal drill seeding operations.
4. An evaluation should be conducted to determine if lime is necessary for temporary seeding. In most soils, it takes up to six months for a pH adjustment to occur following the application of lime. Therefore, it may be difficult to justify the cost of liming a temporary site, especially when the soil will later be moved and re-graded.

### *Construction specifications*

1. Seeding does not immediately stabilize soils. Prior to seeding, install necessary erosion and sediment control practices such as diversions and sediment basins until vegetation is established.
2. To control erosion on bare soil surfaces, plants must be able to germinate and grow. Seedbed preparation is essential. Lime and fertilizer may be incorporated into the top two to four inches of the soil, if possible.
3. Surface Roughening: If the area has been recently loosened or disturbed, no further roughening is required. When the area is compacted, crusted, or hardened, the soil surface shall be loosened by disking, raking, harrowing, or other acceptable means.
4. The appropriate seed shall be evenly applied with a broadcast seeder, drill, cultipacker seeder or hydroseeder. Small grains shall be planted no more than 1.5 inches deep. Small seeds, such as Kentucky Bluegrass, should be planted no more than 0.25 inches deep. Other Grasses and Legumes should be planted from 0.25 inch to 0.5 inches deep.
5. Seedings made in fall for winter cover and during hot and dry summer months shall be mulched according to Mulching (M). Temporary seedings made under favorable soil and site conditions during optimum spring and fall seeding dates may not require mulch.

### *Maintenance considerations*

The frequency of inspections should be in accordance with the Storm Water Management Plan (SWMP). Vegetation is considered established when a density of at least 70 percent of pre-disturbance levels has been reached. Seeded areas should be inspected for failure and any necessary repairs and re-seedings should be made within the same season, if possible.

### *References*


Environmental Protection Agency (EPA), National Pollutant Discharge Elimination System (NPDES). Construction Site Storm Water Runoff Control. Washington, D.C., February, 2003. http://cfpub.epa.gov/npdes/stormwater/menuofbmps/con_site.cfm

Horizon Environmental Services, Inc, Guidance Document Reasonable and Prudent Practices for Stabilization (RAPPS) of Oil and Gas Construction Sites. April 2004.

Keller, Gordon, and James Sherar, Low-Volume Roads Engineering, Best Management Practices Field Guide. United States Department of Agriculture (USDA), Forest Service, US Agency of International Development (USAID), 2005. http://www.blm.gov/bmp/field%20guide.htm

United States Army Corps of Engineers (USACE), Engineering and Design - Handbook for the Preparation of Storm Water Pollution Prevention Plans for Construction Activities. February 1997. http://www.usace.army.mil/inet/usace-docs/eng-pamphlets/ep1110-1-16/

## 7. Riprap

### *Description*

Riprap is a permanent, erosion-resistant layer made of stones or boulders. It is intended to stabilize areas subject to erosion and protect against scour of the soil caused by concentrated, high velocity flows.

### *Applicability*

Riprap can be used for areas subject to erosion or weathering, particularly where conditions prohibit the establishment of re-vegetation or where flow velocities exceed 5 ft/sec. Riprap may be used in the following applications:

Cut-and-fill slopes

Channel side slopes and/or bottoms

Inlets and outlets to sediment traps

Roadside ditches

### *Limitations*

Riprap is limited by steepness of slope, because slopes greater than 1.5:1 have potential riprap loss due to erosion and sliding. When working within flowing streams, measures should be taken to prevent excessive turbidity and erosion during construction. Bypassing base flows or temporarily blocking base flows are two possible methods.

### *Design criteria*

Gradation

A well-graded mixture of rock sizes should be used instead of one uniform size (with the exception of dry stacking boulders). 50% by weight should be larger than the specified design size. The diameter of the largest stone size in such a mixture should be 1.5 times the d50 size with smaller sizes graded down to one inch. When dry stacking up a slope, boulders may be uniform in size or may get gradually smaller as the boulders are placed up the slope.

Quality

Riprap must be durable so that freeze/thaw cycles do not decompose it in a short time. They should be angular and not subject to breaking down when exposed to water or weathering. The specific gravity should be at least 2.5.

Size

The sizes of stones used for riprap protection are determined by purpose and specific site conditions:

1. Slope Stabilization. Riprap stone for slope stabilization not subject to flowing water should be sized for the proposed grade. The gradient of the slope to be stabilized should be less than the natural angle of repose of the stone selected. Angles of repose of riprap stones may be estimated from Figure 11. Riprap used for surface stabilization of slopes does not add significant resistance to sliding or slope failure and should not be considered a retaining wall. Slopes approaching 1.5:1 may require special stability analysis. The inherent stability of the soil must be satisfactory before riprap is used for surface stabilization.
2. Stream bank Protection. If the shear stress is estimated, riprap stone for stream bank protection can be selected from the gradations in Table 5, below. The shear stress can be estimated from the depth of flow and the channel slope (see note for Table 5). The riprap should extend two feet below the channel bottom and be keyed into the bank both at the upstream end and downstream end of the proposed work or reach.

Filter material

Filter material is sometimes used between riprap and the underlying soil surface to prevent soil from moving through the riprap. Filter cloth material or a layer of sand and/or gravel is usually used for the filter.

The design of a sand/gravel filter blanket is based on the ratio of particle size in the overlying filler material to that of the base material in accordance with the criteria below. Multiple layers (each a minimum of 6 inches thick) may be designed to affect a proper filter if necessary. A sand/gravel filter blanket should have the following relationship for a stable design:

$$\frac{\text{d15 filter}}{\text{d85 base}} \leq 5$$

$$5 < \frac{\text{d15 filter}}{\text{d50 base}} \leq 40$$

$$\frac{\text{d50 filter}}{\text{d50 base}} \leq 40$$

The design of a synthetic filter fabric, which may be used with or in place of gravel filters, is based upon the following particle size relationships:

1. Filter fabric covering a base containing 50% or less by weight of fine particles (#200 sieve size):
   a. d85 base (mm)

      $$\frac{\text{EOS*filter fabric (mm)}}{} > 1$$

   b. total open area of filter fabric should not exceed 36 %
2. Filter fabric covering other soils:
   a. EOS is no larger than 0.21 mm (#70 sieve size)
   b. total open area of filter fabric should not exceed 10%

*EOS - Equivalent opening size compared to a U.S. standard sieve size

No filter fabric should have less than 4% open area or an EOS less than U.S. Standard Sieve #100 (0.15 mm). The permeability of the fabric must be greater than that of the soil. The fabric may be made of woven or non-woven monofilament yarns and should meet the following minimum requirements:

Thickness 20-60 mils

Grab strength 90-120 lbs
Conform to ASTM D-1682 or ASTM D-177

### *Construction Specifications*

See Figure 13 for dry stacking boulders. See Sediment Trap for a detail of a riprap lined channel leading into a sediment trap.

1. Subgrade Preparation. Prepare the subgrade for riprap to the required lines and grades shown on the plans. Compact any fill required in the subgrade to a density approximating that of the undisturbed material or overfill depressions with riprap. Remove brush, trees, stumps, and other objectionable material. Cut the subgrade sufficiently deep so that the finished grade of the riprap will be at the elevation of the surrounding area. Channels should be excavated sufficiently to allow placement of the riprap in a manner such that the finished inside dimensions and grade of the riprap meet design specifications.
2. Sand/gravel filter blanket. If using a granular filter, spread filter stone in a uniform layer to the specified depth. Where more than one layer of filter material is used, spread the layers with minimal mixing.
3. Synthetic filter fabric. If using a filter fabric, place the cloth directly on the prepared foundation. Where large stones are to be placed, a 4-inch layer of fine sand or gravel is recommended to protect the filter cloth. Filter fabric is not recommended as a filter on slopes steeper than 2 horizontal to 1 vertical.
4. Stone placement. Place riprap so that it forms dense, well-graded mass of stone with a minimum of voids. The desired distribution of stones throughout the mass may be obtained by selective loading at the quarry and controlled dumping during final placement. Place riprap to its full thickness in one operation. Do not place riprap by dumping through chutes or other methods that cause segregation of stone sizes. If a filter is used, be careful not to dislodge the underlying base filter or damage the filter cloth when placing the stones. If damage occurs, remove the riprap and repair filter.
5. The toe of the riprap should be keyed into a stable foundation at its base as shown in Figure 12 if required for slope stabilization and stream bank protection. The finished slope should be free of pockets of small stone or clusters of large stones. Hand placing may be necessary to achieve proper distribution of stone sizes to produce a relatively smooth, uniform surface. The finished grade of the riprap should blend with the surrounding area.

### *Maintenance considerations*

The frequency of inspections should be in accordance with the Storm Water Management Plan (SWMP). If riprap has been damaged or dislodged, repairs should be made to prevent a progressive failure. If repairs are needed repeatedly at one location, the site should be evaluated to determine if the original design conditions have changed. Channel obstructions such as trees and sediment bars can change flow patterns and cause erosive forces that may damage riprap. Control of weed and brush growth may be needed in some locations.

### *Removal*

Riprap is generally not removed.

## *References*

Environmental Protection Agency (EPA), National Pollutant Discharge Elimination System (NPDES). Construction Site Storm Water Runoff Control. Washington, D.C., February, 2003. http://cfpub.epa.gov/npdes/stormwater/menuofbmps/con_site.cfm

New York State Department of Environmental Conservation, New York Guidelines for Urban Erosion and Sediment Control. New York. Fourth Edition, 1997. http://www.dec.state.ny.us/website/dow/toolbox/escstandards

**Table 5: Riprap Gradations**

| Unit shear stress (Ib/ft$^2$) | $D_{50}$ | $d_{max}$ | Minimum blanket thickness (inches) |
|---|---|---|---|
| 0.67 | 2 | 4 | 6 |
| 2 | 6 | 9 | 14 |
| 3 | 9 | 14 | 20 |
| 4 | 12 | 18 | 27 |
| 5 | 15 | 22 | 32 |
| 6 | 18 | 27 | 32 |
| 7.8 | 21 | 32 | 38 |
| 8 | 24 | 36 | 43 |

Unit shear stress calculated as T=y*d*s where:

T = shear stress in lb/ft$^2$

y = unit weight of water, 62.4 lb/ft$^3$

d = flow depth in ft

s = channel gradient in ft/ft

**Figure 11: Angles of Repose of Riprap Stones**

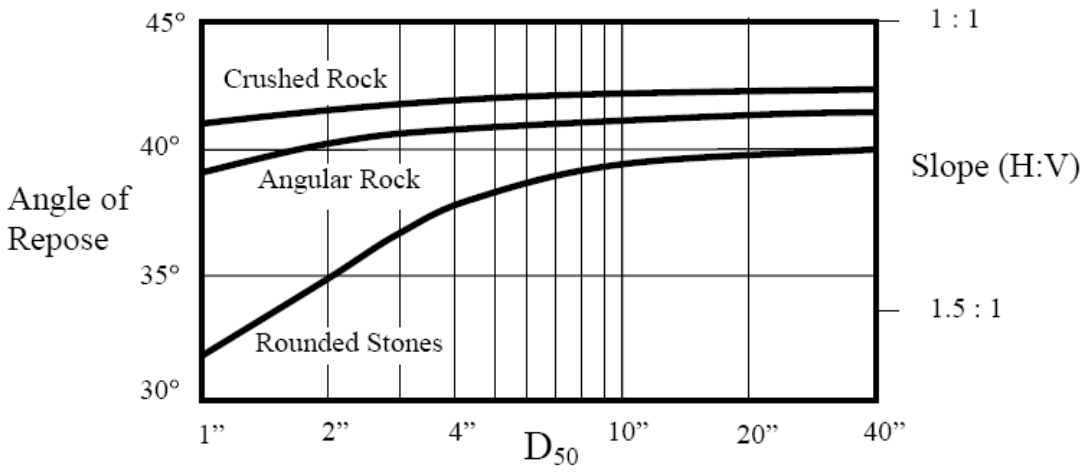


**Figure 12: Typical Riprap Slope Protection Detail**

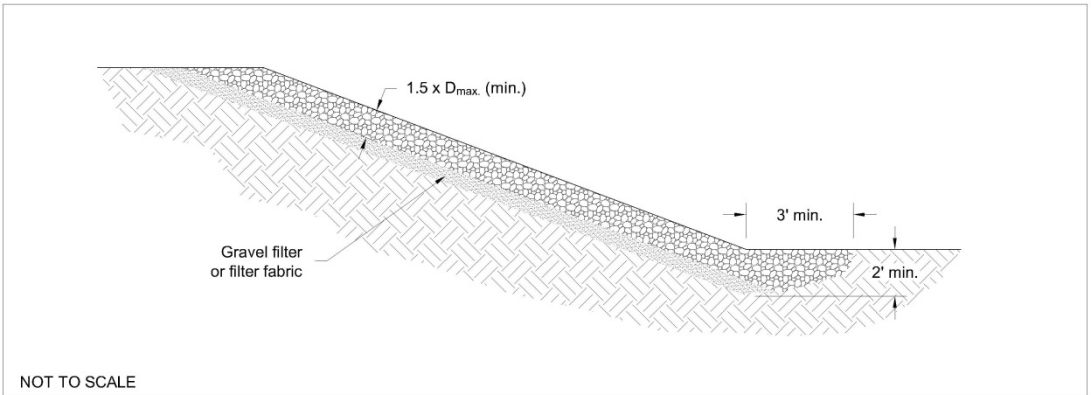
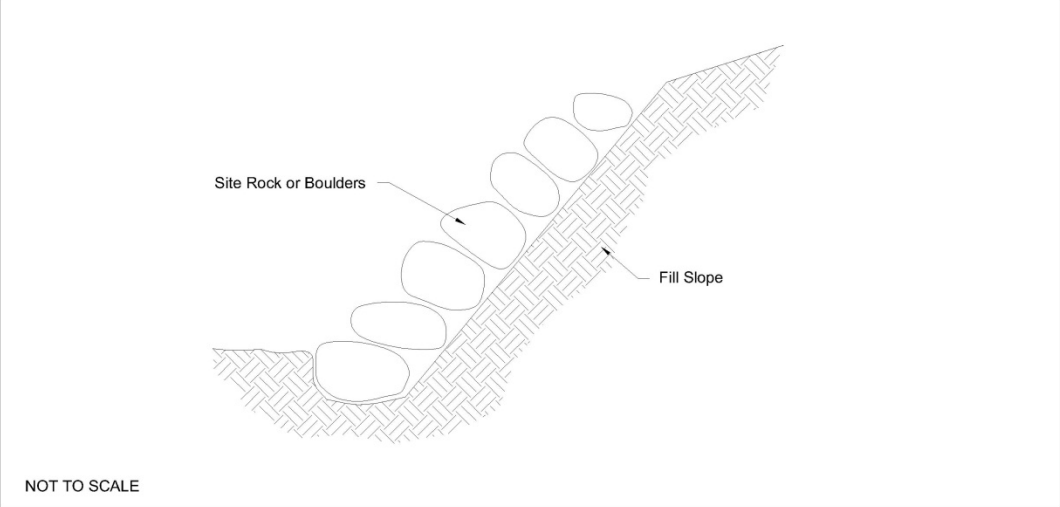



**Figure 13: Typical Boulder Drystack Detail**



## 8. Silt Fence

### *Description*

Silt fences are used as temporary perimeter controls around sites where there will be soil disturbance due to construction activities. They consist of a length of filter fabric stretched between anchoring posts spaced at regular intervals along the site perimeter.

### *Applicability*

Silt fences are generally applicable to construction sites with relatively small drainage areas. They are appropriate in areas where runoff will be occurring as low-level shallow flow, not exceeding 0.5 cubic feet per second. The drainage area for silt fences generally should not exceed 0.25 acre per 100-foot fence length. Slope length above the fence should not exceed 100 feet. Silt fence may be used as temporary slope breakers to reduce runoff velocity.

### *Limitations*

Silt fences should not be installed along areas where rocks or other hard surfaces will prevent uniform anchoring of fence posts and entrenching of the filter fabric. This will greatly reduce the effectiveness of silt fencing and can create runoff channels leading off site.

Silt fences are not suitable for areas where large amounts of concentrated runoff are likely.

Open areas where wind velocity is high may present a maintenance challenge, as high winds may accelerate deterioration of the filter fabric.

Silt fences should not be installed across streams, ditches, or waterways.

When the pores of the fence fabric become clogged with sediment, pools of water are likely to form on the uphill side of fence. Siting and design of the silt fence should account for this and care should be taken to avoid unnecessary diversion of stormwater from these pools that might cause further erosion damage.

### *Design criteria*

The fence should be designed to withstand the runoff from a 2-year, 24-hour storm event.

### *Construction specifications*

1. Erect silt fence according to Figure 14.
2. If standard strength fabric is used in combination with wire mesh, the support posts should be spaced no more than 10 feet apart. If extra-strength fabric is used without wire mesh reinforcement, the support posts should be spaced no more than 6 feet apart.

3. Stakes used to anchor the filter fabric should be either wooden or metal. Wooden stakes should be at least 3 feet long and have a minimum diameter of 2 inches if a hardwood such as oak is used. Softer woods such as pine should be at least 4 inches in diameter. When using metal post in place of wooden stakes, they should have a minimum weight of 1.00 to 1.33 lb/linear foot. If metal posts are used, attachment points are needed for fastening the filter fabric using wire ties. The height of the fence posts should be between 16 and 34 inches above the original ground surface.
4. Material for silt fences should be a pervious sheet of synthetic fabric such as polypropylene, nylon, polyester, or polyethylene yarn, chosen based on minimum synthetic fabric requirements, as shown in the following table:

| Physical Property | Requirements |
|---|---|
| Filtering Efficiency | 75 – 85% (minimum): highly dependent on local conditions |
| Tensile Strength at 20% (maximum) Elongation | Standard Strength: 30 lbs/linear inch (minimum)<br>Extra Strength: 50 lbs/linear inch (minimum) |
| Ultraviolet Radiation | 90% (minimum) |
| Slurry Flow Rate | 0.3 gal/ft$^2$/min (minimum) |

5. Use a continuous roll of fabric to eliminate unwanted gaps in the fence. If a continuous roll of fabric is not available, the fabric should overlap from both directions only at stakes or posts with a minimum overlap of 6 inches.
6. Extend silt fence across grade and upslope for a short distance.
7. Compact backfill at base of fabric.
8. A trench should be excavated to bury the bottom of the fabric fence at least 6 inches below the ground surface. This will help prevent gaps from forming near the ground surface that would render the fencing useless as a sediment barrier
9. If using silt fence as temporary slope breakers to reduce runoff velocity, space according to the following table:

| Slope (%) | Spacing (feet) |
|---|---|
| 5 – 15 | 300 |
| >15 – 30 | 200 |
| >30 | 100 |

### *Maintenance considerations*

The frequency of inspections should be in accordance with the Storm Water Management Plan. Inspect silt fences to ensure that they are intact and that there are no gaps at the fence-ground interface or tears along the length of the fence. If gaps or tears which impact the effectiveness of the BMP are found, they should be repaired or the fabric should be replaced immediately. Accumulated sediments should be removed from the fence base when the sediment reaches one-third to one-half the height of the fence. Sediment removal should occur more frequently if accumulated sediment is creating noticeable strain on the fabric and there is the possibility of the fence failing from a sudden storm event.

### *Removal*

Remove silt fences and all accumulated sediment after uphill drainage areas are stabilized by vegetation or other means.

### *References*

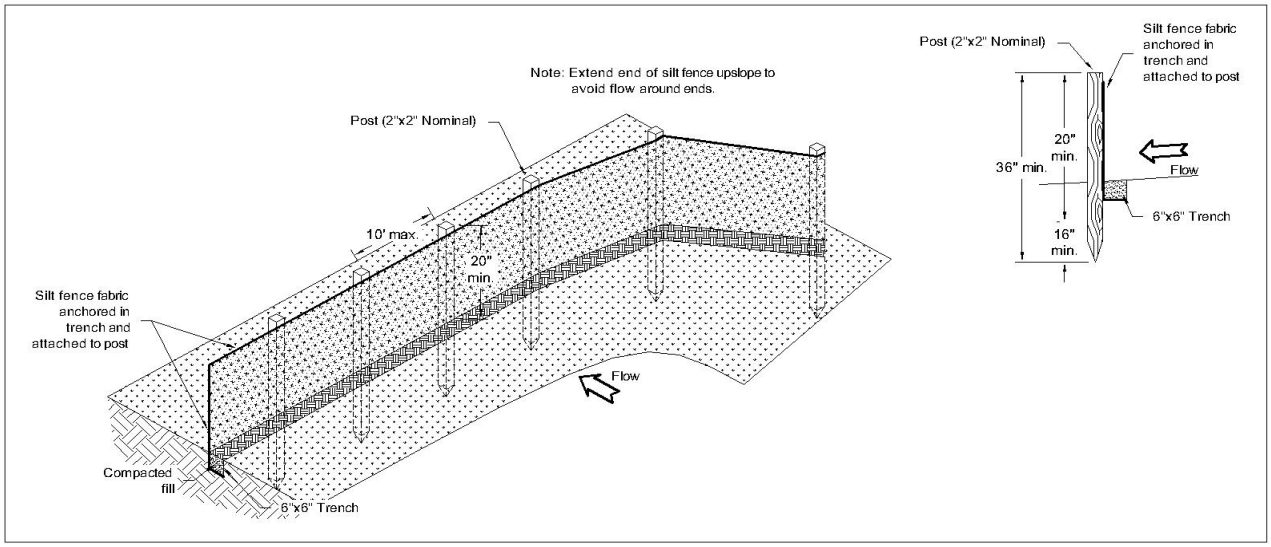
Colorado Department of Transportation (CDOT), Erosion Control and Stormwater Quality Guide. 2002.
http://www.dot.state.co.us/environmental/envWaterQual/wqms4.asp

Environmental Protection Agency (EPA), National Pollutant Discharge Elimination System (NPDES). Construction Site Storm Water Runoff Control. Washington, D.C., February, 2003. <http://cfpub.epa.gov/npdes/stormwater/menuofbmps/con_site.cfm

Horizon Environmental Services, Inc, Guidance Document Reasonable and Prudent Practices for Stabilization (RAPPS) of Oil and Gas Construction Sites. April 2004.

Keller, Gordon, and James Sherar, Low-Volume Roads Engineering, Best Management Practices Field Guide. United States Department of Agriculture (USDA), Forest Service, US Agency of International Development (USAID), 2005. http://www.blm.gov/bmp/field%20guide.htm

**Figure 14: Silt Fence Installation**



## 9. Straw Bale Barrier

### *Description*

A straw bale barrier is a series of entrenched and staked straw bales placed on a level contour to intercept sheet flows. The barrier reduces runoff velocity and filters sediment laden runoff from small drainage areas of disturbed soil. The barrier may also be used to protect against erosion. Straw bale barriers have an estimated design life of three (3) months.

### *Applicability*

Straw bale barriers may be used below disturbed areas subject to sheet and rill erosion where the length of slope above the straw bale barrier does not exceed the following limits:

| Constructed Slope | Percent Slope | Slope Length (ft) |
|---|---|---|
| 2:1 | 50% | 25’ |
| 3:1 | 33% | 50’ |
| 4:1 | 25% | 75’ |

Straw bales may be used in the following applications:

- Below the toe of erodible slopes or other small cleared areas
- At the top of slopes to divert runoff away from disturbed slopes
- As sediment traps at outlets to culverts, ditches, turnouts, etc.
- Along the perimeter of a site
- Around temporary stockpiles and spoil areas
- Along streams and channels for both erosion and sediment control
- As check dams across mildly sloped swales or construction roads
-

### *Limitations*

For short-term use only
For use below small drainage areas less than 2 acres
Decomposes over time
May be consumed by livestock
Straw bales must be certified weed free to avoid invasive weeds that may develop and should not be used in areas where weeds are a concern.
Removal of anchor stakes will be necessary after stabilization is complete

Not recommended for concentrated flow, live streams, or swales where there is the possibility of a washout

### *Design criteria*

No formal design is required.

### *Construction specifications*

See Figure 15 for installation details.

1. Bales shall be placed in a single row on a level contour with ends of adjacent bales tightly abutting one another. Bales shall be certified weed free.
2. Allow sufficient space up slope from the barrier to allow ponding, and to provide room for sediment storage.
3. All bales shall be either wire-bound or string-tied. Straw bales shall be installed so that bindings are oriented around the sides rather than along the tops and bottoms of the bales in order to prevent deterioration of the bindings.
4. A trench shall be excavated the width of a bale and the length of the proposed barrier to a minimum depth of 4 inches. Stake the bales with minimum 2" x 2" x 36" wood stakes or standard "T" or "U" steel posts (minimum weight of 1.33 pounds per linear foot).
5. After the bales are staked and chinked (gaps filled by wedging), the excavated soil shall be backfilled against the barrier. Backfill soil shall conform to the ground level on the downhill side and shall be built up to 4 inches against the uphill side of the barrier.
6. Each bale shall be securely anchored by at least two stakes driven through the bale. The first stake or steel post in each bale shall be driven toward the previously laid bale to force the bales together. Stakes or steel pickets shall be driven a minimum 12 inches deep into the ground to securely anchor the bales.

### *Maintenance considerations*

The frequency of inspections should be in accordance with the Storm water Management Plan. Close attention should be paid to the repair of damaged or rotting bales, end runs and undercutting beneath bales. Necessary repairs to barriers or replacement of bales should be accomplished promptly. Sediment deposits should be removed when the level of deposition reaches approximately one-half the height of the barrier.

### *Removal*

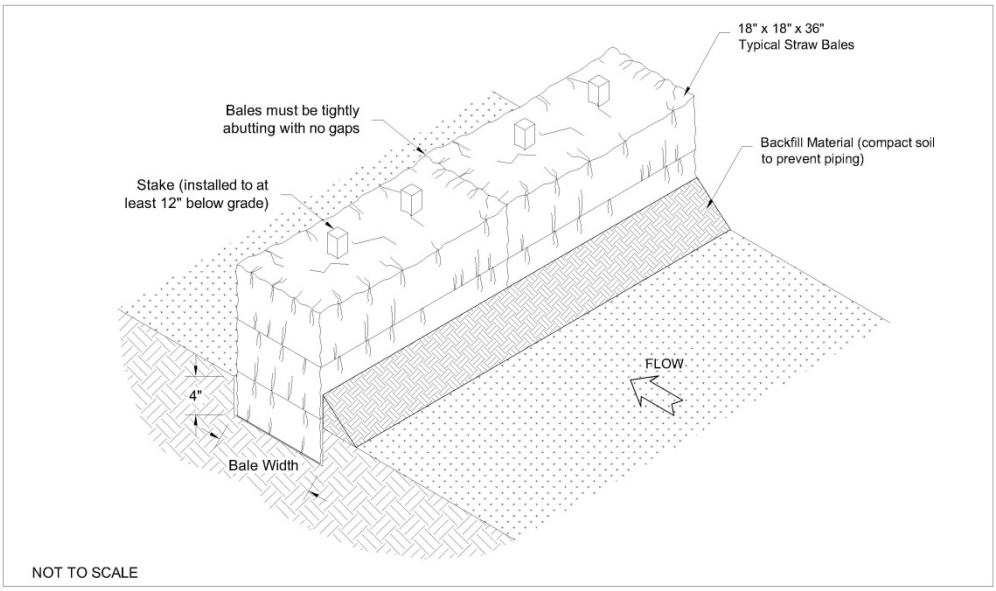
Straw bale barriers may be removed when they have served their usefulness or may remain in place to decompose over time. Straw bales should not be removed, however, until the upslope areas have been permanently stabilized. Any sediment deposits remaining in place after the straw bale barrier is no longer required should be dressed to conform to the existing grade, prepared and seeded.

### *References*

Colorado Department of Transportation (CDOT), Erosion Control and Storm water Quality Guide. 2002. <http://www.dot.state.co.us/environmental/envWaterQual/wqms4.asp>

Horizon Environmental Services, Inc, Guidance Document Reasonable and Prudent Practices for Stabilization (RAPPS) of Oil and Gas Construction Sites. April 2004.

**Figure 15: Straw Bale Installation**


18" x 18" x 36"
Typical Straw Bales
Bales must be tightly
abutting with no gaps
Backfill Material (compact soil
to prevent piping)
Stake (installed to at
least 12" below grade)
FLOW
4"
Bale Width
NOT TO SCALE

## 10. Trench Breakers

### *Description*

Trench breakers, also known as trench plugs, are used to slow the flow of subsurface water along a pipeline trench. Trench breakers may be constructed of materials such as sand bags or polyurethane foam.

### *Applicability*

Trench breakers may be used in the following applications:

On steep slopes
Above wetlands
At waterbody crossings
At road crossings

### *Design criteria*

No formal design is required.

### *Construction specifications*

1. Trench breakers should be installed both before and after the lowering-in of pipeline.
2. An engineer or similarly qualified professional shall determine the need for and spacing of trench breakers. Otherwise, spacing shall be according to the following table:

| Slope (%) | Spacing (feet) |
|---|---|
| 5 – 15 | 300 |
| 15 – 30 | 200 |
| >30 | 100 |

3. At a minimum, install a trench breaker at the base of slopes greater than 5 percent where the base of the slope is less than 50 feet from a waterbody or wetland and where needed to avoid draining a waterbody or wetland.
4. Trench breakers should be installed to the top of the excavated trench line.
5.

### *Maintenance considerations*

The frequency of inspections should be in accordance with the Storm Water Management Plan. Repair any damaged areas.

### *References*

Federal Energy Regulatory Commission (FERC), Upland Erosion Control, Revegetation, and Maintenance Plan. January 2003.

## 11. Water Bars

### *Description*

A water bar is an earthen ridge, or ridge and channel, constructed diagonally across a sloping road, trail, or disturbed area that is subject to erosion. Water bars are normally used for drainage and erosion protection of buried pipelines or closed, blocked, or infrequently used roads to limit the accumulation of erosive volumes of water by diverting surface runoff at pre-designed intervals.

### *Applicability*

Water bars are applicable where runoff protection is needed to prevent erosion on sloping access right-of-ways or long, narrow sloping areas generally less than 100 feet in width. This is a practice that is often used on buried pipelines, limited-use roads, trails, and firebreaks. It is an excellent method of retiring roads and trails as well as abandoned roads where surface water runoff may cause erosion of exposed mineral soil.

### *Limitations*

Not for use on concentrated flows

May cause concentrated flows from sheet flow

- Requires vegetative cover or other filter at discharge point
-

### *Design criteria*

No formal design is required.

### *Construction specifications*

See Figure 13.

1. Clear the base for the ridge before placing fill.
2. Install the water bar across the right-of-way according to Figure 13 as soon as the base is cleared and graded. The off-slope drainage should be 2 to 5 percent.
3. Use a trackhoe or bulldozer to compact the ridge to the design cross section.
4. Vehicle crossings shall be stabilized with gravel. Exposed areas shall be immediately seeded and mulched.
5. Extend the water bar inlet and outlet 1 foot or more beyond the edge of the right-of-way or disturbed area to keep the diverted water from re-entering the area.
6. Space the water bars according to Table 9.
7. Locate the outlet on an undisturbed area. Field spacing shall be adjusted to use the most stable outlet areas. Outlet protection will be provided when natural areas are not adequate.

### *Maintenance considerations*

The frequency of inspections should be in accordance with the Storm Water Management Plan. Inspect water bars for erosion damage and sediment. Check outlet areas and make repairs as needed to restore operation.

### *Water Bar Removal*

If water bars are used on a closed or blocked road, they should be removed prior to re-opening of the road. Water bars on infrequently used roads or other disturbed areas may remain in place as long as necessary.

### *References*

Horizon Environmental Services, Inc, Guidance Document Reasonable and Prudent Practices for Stabilization (RAPPS) of Oil and Gas Construction Sites. April 2004.

Keller, Gordon, and James Sherar, Low-Volume Roads Engineering, Best Management Practices Field Guide. United States Department of Agriculture (USDA), Forest Service, US Agency of International Development (USAID), 2005. <http://www.blm.gov/bmp/field%20guide.htm>

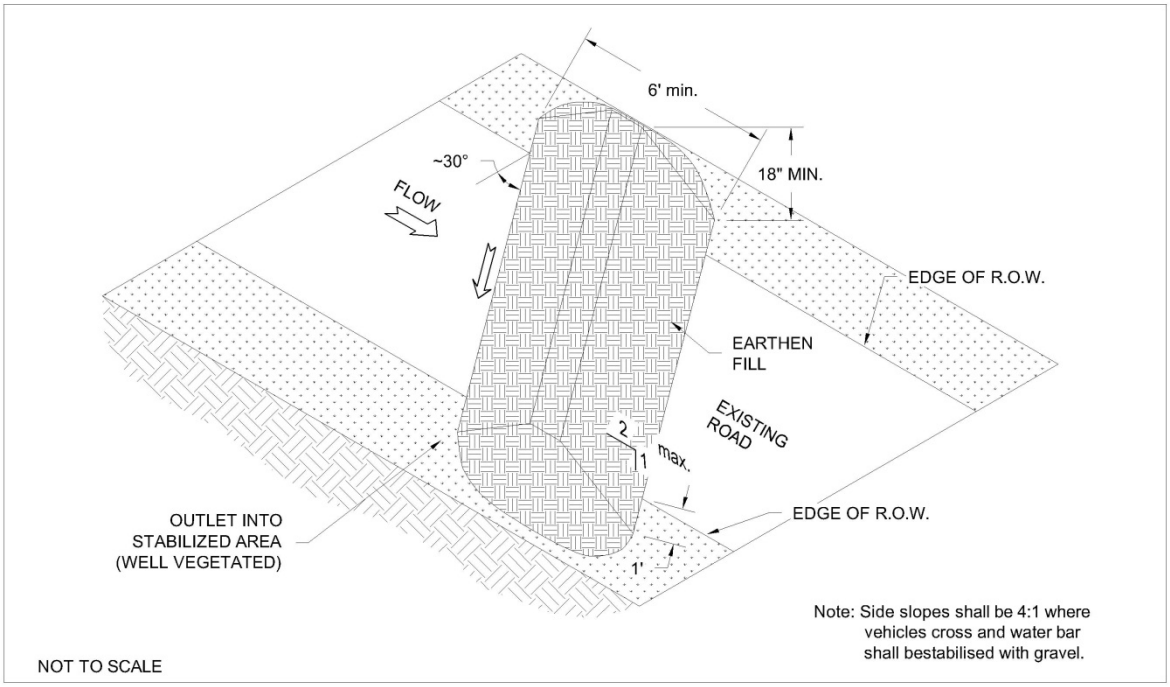
Maine Department of Conservation, Best Management Practices for Forestry: Protecting Maine's Water Quality. Maine Forest Service, Forest Policy and Management Division. Augusta, Maine. 2004. <http://www.state.me.us/doc/mfs/pubs/pdf/bmp_manual/bmp_manual.pdf>

**Table 16: Water Bar Spacing**

| Road/Trail Grade (%) | Low to Non-Erosive Soils (1) | Erosive Soils (2) |
|---|---|---|
| 0 - 5 | 245' | 130' |
| 6 – 10 | 200' | 100' |
| 11 - 15 | 150' | 65' |
| 16 - 20 | 115' | 50' |
| 21 - 30 | 100' | 40' |
| 31+ | 50' | 30' |

[1]Low Erosion Soils = Coarse Rocky Soils, Gravel, and Some Clay
[2]High Erosion Soils = Fine, Friable Soils, Silt, Fine Sands

**Figure 17: Water Bar Installation**



## 12. Vegetated Buffer

### *Description*

Vegetated buffers (also known as vegetated filter strips) are areas of either natural or established vegetation that are maintained to protect the water quality of neighboring areas. Buffers reduce the velocity of storm water runoff, provide an area for the runoff to permeate the soil, contribute to groundwater recharge, and act as filters to catch sediment. The reduction in velocity also helps to prevent soil erosion.

The use of existing natural vegetation is preferred over newly established vegetation for the following reasons:

Can process higher quantities of storm water runoff than newly seeded areas.

Does not require time to establish.

Has a higher filtering capacity than newly planted vegetation because aboveground and root structures are typically denser.

Reduces storm water runoff by intercepting rainfall, promoting infiltration, and lowering the water table through transpiration.

- Provides a fully developed habitat for wildlife.
-

### *Applicability*

Vegetated buffers can be used in any area that is able to support vegetation but they are most effective and beneficial on floodplains, near wetlands, along streambanks, and as stabilized outlets to runoff controls such as diversions, water bars, or culverts. Buffers are also effective in separating land use areas that are not compatible and in protecting wetlands or water bodies by displacing activities that might be potential sources of non-point source pollution.

### *Limitations*

Vegetated buffers require plant growth before they can be effective, and land on which to plant the vegetation must be available.

- Although vegetated buffers help to protect water quality, they usually do not effectively counteract concentrated storm water flows to neighboring or downstream wetlands.

### *Design criteria*

No formal design is required.

### *Construction specifications*

1. Buffer widths should be determined after careful consideration of slope, vegetation, soils, depth to impermeable layers, runoff sediment characteristics, type and quantity of storm water pollutants, and annual rainfall. Buffer widths should increase as slope increases.
2. Zones of vegetation (native vegetation in particular), including grasses, deciduous and evergreen shrubs, and understory and overstory trees, should be intermixed.
3. Fertilizing seeded or planted ground may enhance growth (and improve its effectiveness as a buffer).
4. When using naturally vegetated areas, vegetation should be marked for preservation before clearing activities begin. Barriers may be used to prevent the approach of equipment within protected areas.
5. Direct sediment-laden water onto the naturally vegetated or stabilized planted ground.
6. Do not place any equipment, construction debris, or extra soil in the buffer area.

### *Maintenance considerations*

The frequency of inspections should be in accordance with the Storm Water Management Plan. Keeping vegetation healthy in a recently established buffer requires routine maintenance, which (depending on species, soil types, and climatic conditions) may include weed control, fertilizing, liming, and irrigating. Once established or if using a naturally vegetated area, buffers do not require much maintenance beyond repairing or replacing damaged vegetation. Inspections should focus on encroachment, gully erosion, density of vegetation, evidence of concentrated flows through the areas, and any damage from foot or vehicular traffic. If there is more than 6 inches of sediment in one place, it should be removed.

### *Removal*

During final site cleanup, any barriers placed around preserved natural areas should be removed.

### *References*

Environmental Protection Agency (EPA), National Pollutant Discharge Elimination System (NPDES). Construction Site Storm Water Runoff Control. Washington, D.C., February, 2003. <http://cfpub.epa.gov/npdes/stormwater/menuofbmps/con_site.cfm>

## 13. Wattles

### *Description*

A wattle (also called a fiber roll) consists of straw, flax, or other similar materials bound into a tight tubular roll. When wattles are placed at the toe and on the face of slopes, they intercept runoff, reduce its flow velocity, release the runoff as sheet flow, and provide removal of sediment from the runoff. By interrupting the length of a slope, fiber rolls can also reduce erosion.

### *Applicability*

Wattles may be suitable:

- Along the toe, top, face, and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow
- At the end of a downward slope where it transitions to a steeper slope
- Along the perimeter of a project
- At the overflow locations of sediment traps
- As check dams in unlined ditches
- Around temporary stockpiles

### *Limitations*

- Wattles are not effective unless trenched.
- Wattles at the toe of slopes greater than 5:1 (H:V) should be a minimum of 20-in. diameter or installations achieving the same protection (i.e. stacked smaller diameter wattles, etc.).
- Difficult to move once saturated.
- If not properly staked and trenched in, wattles could be transported by high flows.
- Wattles have a very limited sediment capture zone.
- Wattles should not be used on slopes subject to creep, slumping, or landslide.
- Wattles should not be used where periodic road or surface maintenance activities are expected.

### *Design criteria*

No formal design is required.

### *Construction Specifications*

Wattles should be either prefabricated rolls or rolled tubes of erosion control blanket. (If using an erosion control blanket, roll the length of erosion control blanket into a tube of minimum 8 in. diameter and bind roll at each end and every 4 ft along length of roll with jute-type twine.)
See Figure W-1 for wattles used to control erosion along slopes.

1. Locate wattles on level contours spaced as follows:
    a. Slope inclination of 4:1 (H:V) or flatter: Fiber rolls should be placed at a maximum interval of 20 ft.
    b. Slope inclination between 4:1 and 2:1 (H:V): Fiber Rolls should be placed at a maximum interval of 15 ft. (a closer spacing is more effective).
    c. Slope inclination 2:1 (H:V) or greater: Fiber Rolls should be placed at a maximum interval of 10 ft. (a closer spacing is more effective).
2. Turn the ends of the wattles up slope to prevent runoff from going around the roll.
3. Stake wattles into a 2 to 4 in. deep trench with a width equal to the diameter of the wattle. Drive stakes at the end of each wattle and spaced 4 ft maximum on center.
4. If more than one wattle is placed in a row, the rolls should be overlapped, not abutted.

### *Maintenance considerations*

The frequency of inspections should be in accordance with the Storm Water Management Plan (SWMP). Repair or replace split, torn, unraveling, or slumping rolls. If the wattle is used as a sediment capture device, or as an erosion control device to maintain sheet flows, sediment that accumulates must be periodically removed in order to maintain wattle effectiveness. Sediment should be removed when sediment accumulation reaches one-half the designated sediment storage depth, usually one-half the distance between the top of the wattle and the adjacent ground surface.

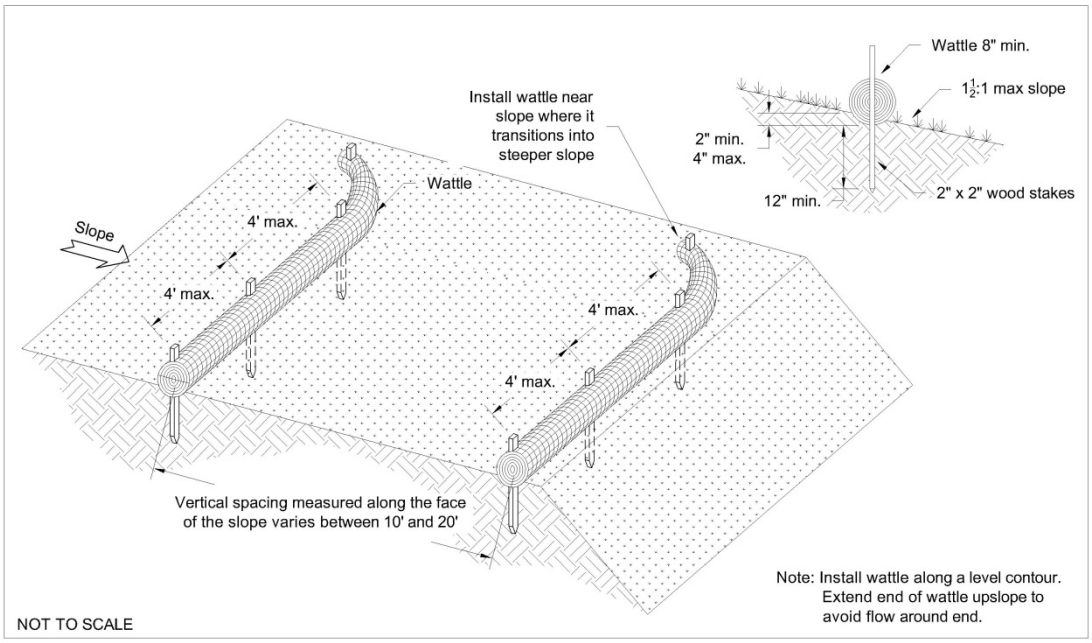
### *Removal*

Wattles are typically left in place. If wattles are removed, collect and dispose of sediment accumulation, and fill and compact holes, trenches, depressions or any other ground disturbance to blend with adjacent ground.

### *References*

California Stormwater Quality Association, Stormwater Best Management Practice (BMP) Handbook – Construction. January, 2003.
<http://www.cabmphandbooks.com/Construction.asp>

**Figure 18: Wattle Installation**



## 14. Soil Retention Measures

BMP Objectives
- Erosion control
- Wind erosion control
- Soil stabilization
- Worker protection

Potential Alternatives
- Mulching
- Temporary seeding
- Geotextiles

### *Definition and Purpose*

**Soil retention measures** are structures or practices used to hold soil in place or to keep it contained within a site boundary. The two main methods of soil retention that will be examined in this fact sheet are structural methods (mainly retaining walls,) and soil binders. Retaining walls are methods of erosion control and also a method of protecting workers from falling or sliding dirt during a construction project. Soil binders consist of applying and maintaining polymeric or lignin sulfonate soil stabilizers or emulsions. They are materials temporarily applied to a soil surface to prevent water and wind erosion during the duration of construction.

### *Applicability*

Reinforced soil-retaining structures such as retaining walls and grading should be used when sites have very steep slopes or loose, highly erodible soils that cause other methods, such as chemical or vegetative stabilization or regarding, to be ineffective. The preconstruction drainage pattern should be maintained to the extent possible.

Soil binders are applied to disturbed areas requiring short-term protection. Because soil binders can often be incorporated into the earth work, they may be a good choice for areas where grading activities will soon resume. Soil binders are also very suitable for use on stockpiles.

### *Limitations*

Structural methods

- Soil retention structures must be designed to handle expected loads.
- Heavy rains or mass wasting may damage or destroy these structures and result in sediment inputs to waterbodies.

Soil binders

- Soil binders are temporary in nature and may need reapplication.
- Soil binders require a minimum curing time as prescribed by the manufacturer, which may be 24 hours or longer until fully effective.
- Soil binders will generally experience spot failures during heavy rainfall events. If runoff penetrates the soil at the top of a slope treated with a soil binder, it is likely that the runoff will undercut the stabilized soil layer and discharge at a point further down slope.
- They do not hold up to pedestrian or vehicular traffic across treated areas.
- Soil surfaces made primarily of silt and clay may not be penetrated by soil binders, particularly when compacted.
- If low temperatures occur within 24 hours of application, soil binders may not cure.
- The water quality impacts of soil binders are relatively unknown and some may have water quality impacts due to their chemical impacts.

### *Siting and Implementation Guidelines*

Structural methods

- To ensure safety of the retaining structure, it should be designed by a qualified engineer who understands all of the design considerations, such as the nature of the soil, location of the ground water table, and the expected loads.
- Take care to ensure that the hydraulic pressure does not build up behind the retaining structure and cause failure.
- Examples of the reinforcing soil retaining structures include:
- *Skeleton sheeting*. This is an inexpensive soil bracing system that requires soil to be cohesive and consists of construction grade lumber being used to support the excavated face of a slope.
- *Continuous sheeting*. This method involves using a material that covers the entire slope continuously, with struts and boards placed along the slope to support the slope face- steel, concrete, or wood are the appropriate materials. An example of a continuous sheeting retaining wall is shown in Figure 1.

**Figure 1**

- *Permanent retaining walls*. Walls of concrete masonry or wood (usually railroad ties) that are left in place after construction is complete in order to provide continued support of the slope. An example of a permanent retaining wall is shown in Figure 2.

**Figure 2**

Soil binders

- Soil type will dictate which soil binder is appropriate to use.
- A soil binder must be environmentally benign, easy to apply, easy to maintain, economical, and shall not stain paved or painted surfaces.

- Avoid over-spray onto the traveled way, sidewalks, lined drainage channels, and existing vegetation.

Selecting a soil binder

- Properties of common soil binders used for erosion control are provided on Table 1. This should be used to select an appropriate binder.

**Table 1: Properties of Soil Binders for Erosion Control**

| Evaluation Criteria | Binder Type | | | |
|---|---|---|---|---|
| | Plant Material Based (Short Lived) | Plant Material Based (Long Lived) | Polymeric Emulsion Blends | Cementitious-Based Binders |
| Relative Cost | Low | Low | Low | Low |
| Resistance to Leaching | High | High | Low to Moderate | Moderate |
| Resistance to Abrasion | Moderate | Low | Moderate to High | Moderate to High |
| Longevity | Short to Medium | Medium | Medium to Long | Medium |
| Minimum Curing Time Before Rain | 9 to 18 hours | 19 to 24 hours | 0 to 24 hours | 4 to 8 hours |
| Compatibility with Existing Vegetation | Good | Poor | Poor | Poor |
| Mode of Degradation | Biodegradable | Biodegradable | Photodegradable/ Chemically Degradable | Photodegradable/ Chemically Degradable |
| Labor Intensive | No | No | No | No |
| Specialized Application Equipment | Water Truck or Hydraulic Mulcher | Water Truck or Hydraulic Mulcher | Water Truck or Hydraulic Mulcher | Water Truck or Hydraulic Mulcher |
| Liquid/Powder | Powder | Liquid | Liquid/Powder | Powder |
| Surface Crusting | Yes, but dissolves on rewetting | Yes | Yes, but dissolves on rewetting | Yes |
| Clean Up | Water | Water | Water | Water |
| Erosion Control Application Rate | Varies | Varies | Varies | 4,000 to 12,000 lbs/acre |

- *Soil types and surface materials*- Fines and moisture content are key properties of surface materials. Consider a soil binder's ability to penetrate, likelihood of leaching, and ability to form a surface crust on the surface materials.
- *Frequency of application*- The frequency of application can be affected by subgrade conditions, surface type, climate, and maintenance schedule. Frequent applications could lead to high costs. Application frequency may be minimized if the soil binder has good penetration, low evaporation, and good longevity.
- Examples of plant material based (short lived) binders are Guar, Psyllium, and Starch.
- Examples of plant material based (long lived) binders are Pitch and Rosin Emulsion.
- Examples of Polymeric Emulsion Blend Binders are Acrylic Copolymers, Liquid Polymers of Methacrylates and Acrylates, Copolymers of Sodium Acrylates and Acrylamides, Poly-Acrylamide and Copolymer of Acrylamide, and Hydro-Colloid Polymers.

The main Cementitious-based binder is Gypsum.

- Applying Soil Binders

  - Follow manufacturer's written recommendations for application rates, pre-wetting of application area, and cleaning of equipment after use.
  - Prior to application, roughen embankment and fill areas.
  - Consider the drying time for the selected soil binder and apply with sufficient time before anticipated rainfall.

**Maintenance**

Structural methods

- Inspect structures periodically, particularly after rainstorms.
- Repair any damage immediately, prior to any reinstallation of the materials.

Soil binders

- Inspect high traffic areas on a daily basis and lower traffic areas on a weekly basis.
- Reapply the selected soil binder as needed for proper maintenance.

**Cost**

Structural methods

These structures can be expensive because they require a professional engineer to develop a design (estimate to be 25 to 30 percent of construction costs.) Capital costs include mobilization, grading, grooving, tracking and compacting fill, and installing the structures.

Soil binders

**Table 2: Approximate Costs for Soil Binders**

| Soil Binder | Cost per Acre |
|---|---|
| Plant-Material Based (Short Lived) Binders | $400 |
| Plant-Material Based (Long Lived) Binders | $1,200 |
| Polymeric Emulsion Blend Binders | $400 |
| Cementitious-Based Binders | $800 |

## Effectiveness

If properly designed and installed, these methods can effectively prevent erosion and mass wasting in areas with steep slopes and erodible soils.

**Sources**


- Picture Source: U.S. Environmental Protection Agency, National Pollutant Discharge Elimination System (NPDES), "Construction Site Storm Water Runoff Control: Soil Retention", http://cfpub.epa.gov/npdes/stormwater/menuofbmps/site_32.cfm
- Figure 1 Source: Access Downtown Website. Bellevue, Washington. July 26, 2002 Photo. http://www.accessdowntown.com/Project%20Pages/Current%20NE%208th%20pics/NE8thphotos.htm
- Figure 2 Source: Leah Blevins, 07/02/2004.
- *California Stormwater Quality Association Stormwater Best Management Practice Handbook Construction*, "Soil Binders Fact-sheet",1993. www.cabmphandbooks.com/construction.asp
- National Pollutant Discharge Elimination System (NPDES) website, "Construction Site Storm Water Runoff Control: Soil Retention." http://cfpub.epa.gov/npdes/stormwater/menuofbmps/site_32.cfm
- *Erosion and Sediment Control Best Management Practices: Field Manual,* Montana Department of Transportation, "Soil Binder Fact Sheet", 2003. www.mdt.state.mt.us/research/projects/env/erosion.shtml

## 15. Chemical Stabilization

BMP Objectives
- Reduce erosion
- Improve settling of suspended sediment
- Soil stabilization
- Wind erosion control
- Dust control

Potential Alternatives
- Temporary seeding
- Mulching
- Sod stabilization measures
- Soil retention measures
- Geotextiles

## Definition and Purpose

**Chemical stabilizers** provide temporary soil stabilization to disturbed soils. Also known as soil binders or soil palliatives, materials made of vinyl, asphalt, or rubber ore sprayed onto the surface of exposed soils to hold the soil in place and protect against erosion from runoff and wind.

### Applicability

Chemical stabilization can be used in areas where other stabilization methods such as seeding and vegetation are not effective because of environmental constraints. They can be used on:

- Rough graded soils that will be inactive for a period of time,
- Final graded soils before application of final stabilization,
- Temporary haul roads prior to placement of crushed rock surfacing,
- Compacted soil road base,
- Construction staging, materials storage, and layout areas,
- Soil stockpiles, and
- Areas that will be mulched.

They can also be applied to stormwater as it enters sediment basins. This will cause soil particles to bind together and settle within the pond.

Chemical stabilization should be used in combination with other BMPs, such as vegetative or perimeter controls.

**Limitations**

- Chemical stabilizers can create impervious surfaces where water cannot infiltrate, increasing the rate of storm water runoff.
- Overuse of these stabilizers may adversely affect water quality.
- Chemical stabilization is usually more expensive than vegetative practices.
- Experience with chemical stabilizers is much more limited than with vegetative BMPs.
- Chemical stabilizers shall not be applied directly to water, or a slope flowing directly into a water body without passing through a sediment trap or basin.
- These stabilizers are usually more expensive than vegetative practices.

**Siting and Implementation Guidelines**

- Chemical stabilizers are available in emulsions, powders, and gel bars or logs.
- The application rates and procedures recommended by the manufacturer of a chemical stabilization product should be followed as closely as possible to prevent the product from forming ponds and to avoid creating impervious areas where storm water cannot infiltrate.
- Chemical stabilizers should be used in conjunction with, not in place of other BMPs.
- Stormwater runoff from chemically stabilized soil should pass through a sediment control BMP prior to discharging to surface waters.
- The use of silt fences should be maximized in chemically stabilized areas.

**Maintenance**

- Chemically stabilized areas should be regularly inspected for signs of erosion. Stabilizers should be reapplied if necessary.
- Stabilizers should be reapplied on actively worked areas after a 48-hour period.
- If chemically stabilized soil is left undisturbed a reapplication may be necessary after two months.
- More applications may be needed for steep slopes, silty and clayey soils, long grades and high precipitation areas.

**Cost**

Polyacrylamide, one of the more common soil palliatives, costs between $4.00 and $35.00 per pound; a pound can stabilize approximately one acre of land.

**Effectiveness**

Effectiveness ranges from 70 to 90 percent, varying by the type of chemical stabilization method used. Effectiveness of each individual stabilizer type depends on soil type, application method, and individual chemical characteristics of the polymer.

**Sources**


- Picture Source: U.S. Environmental Protection Agency, National Pollutant Discharge Elimination System (NPDES), "Construction Site Storm Water Runoff Control: Chemical Stabilization", http://cfpub.epa.gov/npdes/stormwater/menuofbmps/site_42.cfm
- *California Stormwater Quality Association Stormwater Best Management Practice Handbook Construction*, "Polyacrylamide Fact-sheet", 1993. www.cabmphandbooks.com/construction.asp
- U.S. Environmental Protection Agency National Pollutant Discharge Elimination System (NPDES) website, "Construction Site Storm Water Runoff Control: Chemical Stabilization" http://cfpub.epa.gov/npdes/stormwater/menuofbmps/site_42.cfm
- *Storm Water Management For Industrial Activities, Developing Pollution Prevention Plans and Best Management Practices, Chapter Four.* U.S. Environmental Protection Agency. "Chemical Stabilization Fact-sheet", 1992. www.epa.gov/npdes/pubs/chap04_inguide.pdf
- *Tennessee Erosion and Sediment Control Handbook*, Tennessee Department of Environment and Conservation. "Polyacrylemide Fact-Sheet", 2002. www.state.tn.us/environment/wpc/sed_ero_controlhandbook/

## 16. Stabilized Construction Entrances/Exits

BMP Objectives
- Erosion control
- Sediment control
- Tracking control

Potential Alternatives
- None

## Definition and Purpose

**Stabilizing a construction entrance** consists of a stone-stabilized pad located at any point where traffic will be leaving a construction site to a public roadway. Installing a pad of gravel over filter cloth where construction traffic leaves a site causes mud and sediment to be removed from the vehicle's wheels when it drives over the gravel pad, and offsite transport of soil is reduced. The filter fabric separates the gravel from the soil below, preventing the gravel from being ground into the soil.

In addition to the gravel, it is also wise to establish a vehicle washing station at the site entrance. Runoff from this washing station should be diverted into a sediment trap and disposed of properly.

### Applicability

Construction entrance/exit stabilization is applicable at any location where construction traffic leaves or enters an existing paved road. This is a very useful public relations tool, as the entrance/exit is the most publicly visible aspect of many construction sites. Entrance stabilization can improve the appearance to passersby and improves public perception.

This practice is also useful on sites adjacent to water bodies, and where surrounding soils are poor.

## Limitations

- Despite the stabilization mechanisms, some soil may still be deposited from construction vehicles onto paved surfaces, necessitating sweeping of the paved area.
- If using a wash station, a reliable water source must be made available.
- Entrances/exits require periodic top dressing with additional stones.
- Entrances/exits should be constructed on level ground only.

## Siting and Implementation Guidelines

- Figure 1 on the Diagrams page shows a typical construction exit.
- Entrances should be stabilized before the construction begins.
- Make the entrances long and wide enough that the largest vehicle to enter the site will fit in the entrance with room to spare.
- If it is expected to be a high-traffic entrance it should be wide enough for the passage of two vehicles at the same time with room to spare.
- If a site entrance leads to a paved road, the end of the entrance should be "flared" (made wider as in the shape of a funnel) so that long vehicles do not leave the stabilized area when turning onto or off of the paved roadway.
- Stones and gravel used in stabilization should be large enough that they are not carried away on construction traffic. They should also not be sharp-edged stones because of the risk of punctured vehicle tires.
- Install the gravel at a depth of at least 6 inches the entire length and width of the entrance.
- Limit the points of entrance/exit to the construction site.
- Limit the speed of entering vehicles to control dust.
- Properly grade each construction entrance to prevent runoff from leaving the site.

## Maintenance

- Inspect and maintain entrances until construction site has been fully stabilized.
- Periodically add stone and gravel to the entrance to maintain effectiveness.
- Sweep errant soil immediately for proper disposal.
- Periodically remove the sediment from traps.
- Keep all temporary roadway ditches clear.
- Remove gravel and filter fabric at the end of construction.

## Cost

Average annual cost for installation and maintenance may vary from $1,200 to $4,800 each, averaging $2,400 per entrance. Costs will increase with the addition of a washing rack and sediment trap. With the wash rack, costs range from $1,200 to $6,000, averaging $3,600 per entrance.

**Effectiveness**

This method is effective only if it is carried out on all entrances. Otherwise the sediment saved at one entrance exits another. Effectiveness is optimized when a wash station is installed and used.

**Sources**

- Picture source: U.S. Environmental Protection Agency, National Pollutant Discharge Elimination System (NPDES), "Construction Site Storm Water Runoff Control: Construction Entrances", http://cfpub.epa.gov/npdes/stormwater/menuofbmps/site_7.cfm
- Figures 1 Source: *Tennessee Erosion and Sediment Control Handbook*, Tennessee Department of Environment and Conservation. "Construction Exit Fact-Sheet", 2002. www.state.tn.us/environment/wpc/sed_ero_controlhandbook/
- *California Stormwater Quality Association Stormwater Best Management Practice Handbook Construction*, "Stabilized Construction Entrance/Exit Fact-sheet",1993. www.cabmphandbooks.com/construction.asp
- National Pollutant Discharge Elimination System (NPDES) website, "Construction Site Storm Water Runoff Control: Construction Entrances." http://cfpub.epa.gov/npdes/stormwater/menuofbmps/site_7.cfm
- *Tennessee Erosion and Sediment Control Handbook*, Tennessee Department of Environment and Conservation. "Construction Exit Fact-Sheet", 2002. www.state.tn.us/environment/wpc/sed_ero_controlhandbook/

Diagrams

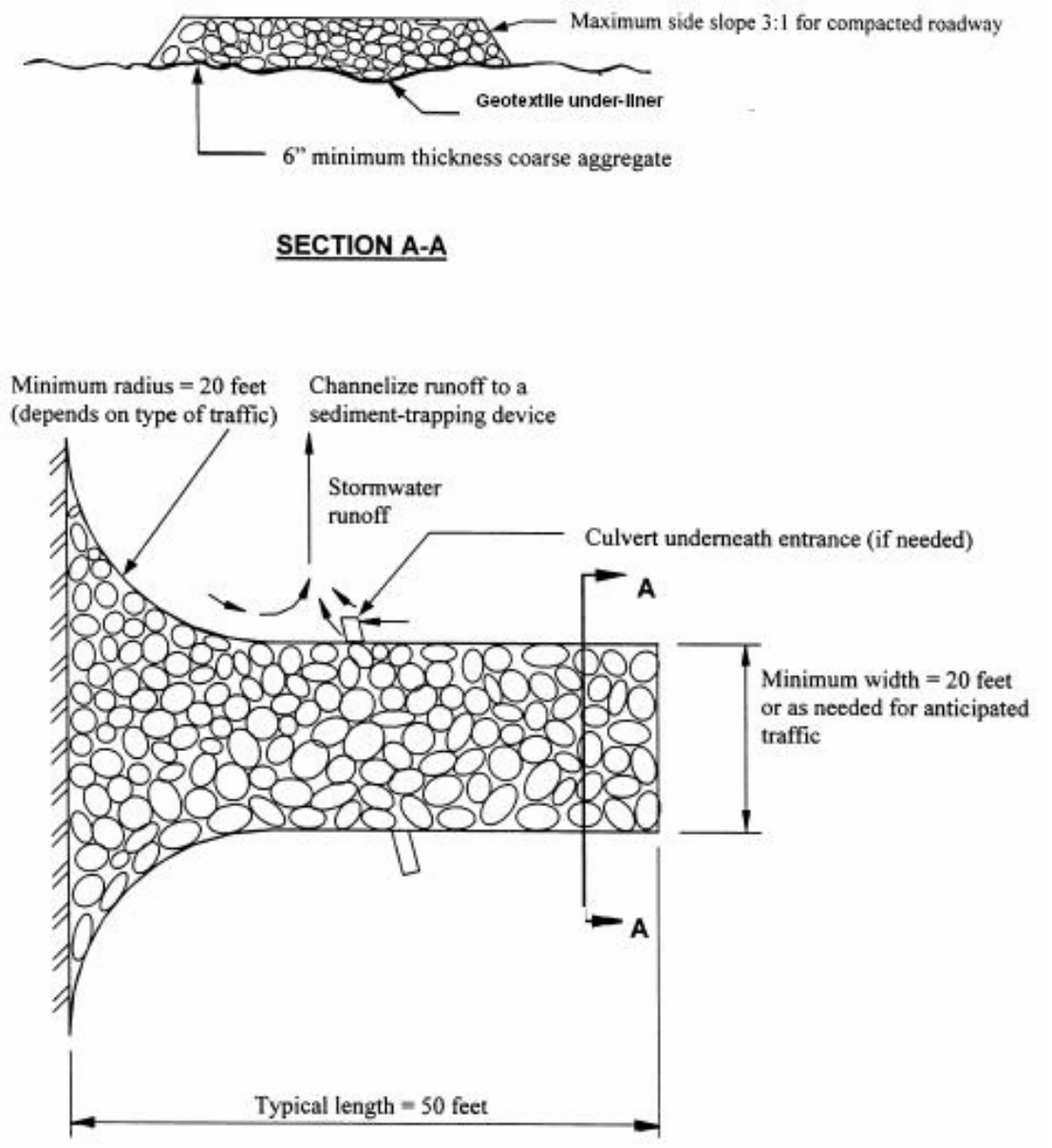



**Figure 1: Stabilized Construction Exit**

## 17. Dust Control

BMP Objectives
- Sediment control
- Wind erosion control

Potential Alternatives
- None

## Definition and Purpose

**Dust control** or wind erosion control consists of applying dust suppressants as necessary to prevent soil erosion. Construction sites are good candidates for dust control measures because land disturbance from clearing and excavation generates a large amount of soil disturbance and open space for wind to pick up dust particles. The two main threats from dust are: 1) sediment and water pollution from dust carried off-site, and 2) respiratory health problems and inhospitable working environment due to blowing dust problems. In accordance with City of Casper Ordinance, watering of construction areas shall not constitute an approved BMP for erosion and sediment control. Chemical stabilizers shall be used for sediment and erosion control.

### Applicability

These controls should be considered for any exposed soils that may be eroded by the wind. Earthmoving activities are the major source of dust, but any traffic can contribute. They are also useful for soil storage piles and areas with unstabilized areas.

### Limitations

- Some types must be reapplied or replenished regularly. If evaporation is high, water reapplication may need to be nearly constant.
- The spray of water may cause increased offsite tracking of mud.
- These methods are not as effective as other controls, such as seeding and mulching.
- Effectiveness depends on soil, temperature, humidity, wind velocity, and wind

direction.
- Over watering may cause erosion.

**Siting and Implementation Guidelines**

- The amount of soil exposed will dictate the quantity of dust generation and transport.
- If land must be disturbed, use additional erosion and stabilization methods
- Table 1 shows a list of dust control options, and where they can be effectively utilized. See other Fact Sheets for more information.

**Table 1: Appropriate Site Conditions for Dust Control Practices**

| Site Conditions | Practices | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Permanent Vegetation | Mulch | Watering | Chemical Suppression | Gravel or Asphalt | Silt Fence | Construction Entrance | Truck Covers | Minimize Disturbed Area |
| Not Subject to Traffic | X | X | X | X | X | | | | X |
| Subject to Traffic | | | X | X | X | | X | | X |
| Stock Pile Stabilization | | | X | X | | X | | | X |
| Demolition | | | X | | | | X | X | |
| Clearing/ Excavating | | | X | X | | X | | | X |
| Truck Traffic on Unpaved Roads | | | X | X | X | | X | X | |
| Mud/Dirt Carry Out | | | | | X | | X | | |

**Maintenance**

- For maintenance of various methods, see other Fact Sheets.
- Monitor BMPs for effectiveness.

**Cost**

A manufacturer of a chemical stabilizer estimated the cost to be $1,089 per acre for application to road surfaces, but the costs could vary widely. Also, aggregate costs could be much higher because of the necessity of frequent application.

**Effectiveness**

The methods have varying levels of effectiveness, and most can be found on their individual fact sheets. Chemical soil treatments effectiveness ranges from 70 to 90 percent. Water spraying is also effective in the short time until it dries.

**Sources**


- Picture Source: Soltac, Applications Methods website, www.soiltac.com/Application_Methods.html
- *California Stormwater Quality Association Stormwater Best Management Practice Handbook Construction*, "Wind Erosion Control Fact-sheet",1993. www.cabmphandbooks.com/construction.asp
- *Erosion and Sediment Control Best Management Practices: Field Manual,* Montana Department of Transportation, "Wind Erosion Control Fact Sheet", 2003. www.mdt.state.mt.us/research/projects/env/erosion.shtml
- National Pollutant Discharge Elimination System (NPDES) website, "Construction Site Storm Water Runoff Control: Dust Control." http://cfpub.epa.gov/npdes/stormwater/menuofbmps/site_11.cfm
- *Storm Water Management For Industrial Activities, Developing Pollution Prevention Plans and Best Management Practices, Chapter Four.* U.S. Environmental Protection Agency. "Dust Control (Land Disturbance and Demolition Areas Fact- sheet", 1992. www.epa.gov/npdes/pubs/chap04_inguide.pdf
- *Casper Wyoming Municipal Code*. Chapter 12.20.065, "Erosion and Sediment Control- Plan Requirements." http://municipalcodes.lexisnexis.com/codes/casper/

## 18. Street Sweeping and Vacuuming

BMP Objectives
- Sediment control
- Tracking control
- Soil stabilization

Potential Alternatives
- None

## Definition and Purpose

**Street sweeping** is a practice used to remove soil and other sediments from streets and roadways in order to prevent them from entering storm drains and receiving. Self-propelled and walk behind equipment are used in the sweeping and vacuuming process.

### Applicability

It is appropriate to sweep the streets anywhere where sediment is tracked onto public or private paved streets, typically at the area of construction entrance/exit.

### Limitations

- Sweeping is not very effective when the sediment is wet, or when it is caked on.
- Do not used kick brooms or sweeper attachments.
- Visible sediment must be swept on a daily basis.

### Siting and Implementation Guidelines

- Control the number of entrances/exits so that sweeping will be necessary in fewer places.
- Sweep sediment on a daily basis.
- Do not use kick brooms or sweeper attachments, as dirt will only be spread, not removed.

- If there is no trash or debris, consider incorporating the removed sediment back into the project.

**Maintenance**

- Inspect access points at least daily to sweep up sediment.
- Do not sweep up any unknown substances.
- Adjust brooms frequently, maximizing the sweeping operations.

**Cost**

Rental rates vary depending on the size of the sweeper. Rates range from $58/hour to
$88/hour, plus operator costs.

**Effectiveness**

If used at an appropriately frequent rate, sweepers can remove any sediment on paved ground.

**Sources**


- Picture Source: City of Berkeley, California Public Works Department, "Residential Street Sweeping Program" http://www.ci.berkeley.ca.us/pw/swm/stsweep.html
- *California Stormwater Quality Association Stormwater Best Management Practice Handbook Construction*, "Street Sweeping and Vacuuming Fact-sheet", 1993. www.cabmphandbooks.com/construction.asp
- *Erosion and Sediment Control Best Management Practices: Field Manual,* Montana Department of Transportation, "Street Sweeping and Vacuuming Fact Sheet", 2003. www.mdt.state.mt.us/research/projects/env/erosion.shtml

# APPENDIX E

# SWPPP TRAINING LOG

# Stormwater Pollution Prevention Plan Training Log

**Bill Sanderson Gas Plant Project**

Date:_____

Trainer:_____

Topics Covered:

- □ Storm Water Regulations
- □ Purpose of the Storm Water Permit
- □ Requirements of the Storm Water Permit
- □ Components of the SWPPP
- □ Good Housekeeping Procedures
- □ Best Management Practices
- □ Inspections
- □ Record Keeping/Reporting
- □ Storm Water Discharges
- □ Non-Storm Water Discharges
- □ Changes to the SWPPP
- □ Other: _____

| | Printed Name | Company | Signature | Date |
|---|---|---|---|---|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |
| 6 | | | | |
| 7 | | | | |
| 8 | | | | |
| 9 | | | | |
| 10 | | | | |
| | | | | |
| | | | | |

# APPENDIX F

# Stormwater Inspection and Corrective Action Form

# Inspection and Corrective Action Form

Project name: _____

Date of inspection: _____

Inspector: _____

This inspection is a:

- ☐ 14-day inspection (active const.)
- ☐ Monthly inspection (site inactive)
- ☐ Rain event inspection (must inspect w/in 24 hours of event)

## BEST MANAGEMENT PRACTICES (BMPs)

### Erosion and Sediment Controls:

**Silt fence, straw roll (wattle), and rock check dams:**

- ☐ Silt fence, straw roll, and rock check dams are in good condition.
- ☐ Silt fence, straw roll, and rock check dams need the following repairs, maintenance, changes (note needed activity and location):

_____

_____

_____

_____

_____

**Storm water diversion trenches and ditch relief culverts:**

- ☐ Diversion trenches and ditch relief culverts are in good condition.
- ☐ Diversion trenches and ditch relief culverts need the following repairs, maintenance, changes (note needed activity and location):

_____

_____

_____

_____

_____

**Slope barriers:**

☐ Slope barriers are in good condition.

☐ Slope barriers need the following repairs, maintenance, changes (note needed activity and location):

_____

_____

_____

_____

_____

**Mulched areas:**

☐ Mulched areas are in good condition.

☐ Mulched areas need the following repairs, maintenance, changes (note needed activity and location):

_____

_____

_____

_____

_____

**Water bars:**

☐ Water bars are in good condition.

☐ Water bars need the following repairs, maintenance, changes (note needed activity and location):

_____

_____

_____

_____

_____

**Diversion trenches:**

☐ Diversion dips are in good condition.

☐ Diversion dips need the following repairs, maintenance, changes (note needed activity and location):

_____

_____

_____

_____

_____

**Other BMPs:**

Types: _____

Locations: _____

☐ BMPs are in good condition.

☐ BMPs need the following repairs, maintenance, changes (note needed activity and location):

_____

_____

_____

_____

_____

# OPERATIONAL CONTROLS

| | | | |
|---|---|---|---|
| Dust control measures being implemented? | ☐ Yes | ☐ No | ☐ N/A |
| Trash is being contained and hauled off site? | ☐ Yes | ☐ No | ☐ N/A |
| Fuel storage area(s) in conformance with site SPCC? | ☐ Yes | ☐ No | ☐ N/A |
| Sanitary facilities properly located and secured? | ☐ Yes | ☐ No | ☐ N/A |
| Site egress locations free of vehicle-tracked sediment | ☐ Yes | ☐ No | ☐ N/A |
| Materials storage areas protected from run-on/runoff? | ☐ Yes | ☐ No | ☐ N/A |

Note any deficiencies and repairs needed for these BMPs.

_____

_____

_____

Briefly describe any repairs or changes to the SWPPP implemented as a result of this inspection.

_____

_____

_____

_____

_____

☐ Check here if the facility *is in compliance* with the site SWPPP and the general storm water permit.

**Certification:** I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

_____ _____

Printed Name of Person Signing Title

_____ _____ _____

Signature Date Telephone

# APPENDIX G

# Completed Stormwater Inspection/Corrective Action Forms