Relicensing Study 3.1.3

Northfield Mountain Pumped Storage Project Sediment Management Plan

Upper Reservoir Dewatering Protocols

Northfield Mountain Pumped Storage Project (No. 2485)

FirstLight Power Resources

JUNE 2017

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ABBREVIATIONS

BMP	Best Management Practice
FERC	Federal Energy Regulatory Commission
Final Report	Northfield Mountain Pumped Storage Project Sediment Management Plan Final Report (October 2016)
FirstLight	FirstLight Power Resources
ft	Foot or feet
GIS	Geographic Information System
GPS	Global Positioning System
MA	Massachusetts
MADEP	Massachusetts Department of Environmental Protection
MW	megawatt
NTU	Nephelometric Turbidity Unit
PE	Professional Engineer
PG	Professional Geologist
QAPP	Quality Assurance Project Plan
SCADA	Supervisory Control and Data Acquisition
SSC	Suspended Sediment Concentration
TFI	Turners Falls Impoundment
the Plan	Northfield Mountain Pumped Storage Project Sediment Management Plan
the Project	Northfield Mountain Pumped Storage Project

1 INTRODUCTION

The Northfield Mountain Pumped Storage Project (the Project) is a 1,168-MW pumped storage hydroelectric project, completed in 1972 along the Connecticut River near Northfield, MA. The Project is owned by FirstLight Power Resources (FirstLight) and consists of an Upper Reservoir, underground powerhouse, four reversible pump-turbine generators, an underground pressure shaft, four penstocks and draft tubes, and a mile-long tailrace tunnel connecting the powerhouse to the Connecticut River. An approximately 20-mile segment of the Connecticut River, technically referred to as the Turners Falls Impoundment (TFI), serves as the Project's Lower Reservoir. The manmade Upper Reservoir is approximately 286 acres in area at elevation 1000.5 feet and contains an approximately 1,800 ft. long by 130 ft. wide intake channel. The Upper Reservoir was formed with four earth-core rockfill embankment structures and a concrete gravity dam.

Since 2010, FirstLight has completed several field data collection, data analysis, and modeling efforts to better understand sediment dynamics in the Connecticut River and at the Project, including both the Upper Reservoir and tailrace areas. The work was completed both as part of the Federal Energy Regulatory Commission (FERC) relicensing process (as Study No. 3.1.3) and in response to an Administrative Order issued by the United States Environmental Protection Agency (USEPA) dated August 4, 2010. The work was described as part of the July 15, 2011 *Northfield Mountain Pumped Storage Project Sediment Management Plan* (the Plan)[1], which was developed in consultation with the USEPA and the Massachusetts Department of Environmental Protection (MADEP).

Efforts associated with Study No. 3.1.3 were described in detail in the *Northfield Mountain Pumped Storage Project Sediment Management Plan Final Report* (Final Report), dated October 2016. The Final Report is integral to this document. As described in the Final Report, during normal Project operations (i.e., generation) material sediment releases to the Connecticut River are highly unlikely due to a combination of factors including the physical characteristics of the sediment, the velocity of the water during generation, the configuration of the Upper Reservoir intake structure, and the water level of the Upper Reservoir. Based on this, and other findings, FirstLight proposed adaptive, multi-step sediment management measures in the Final Report, which focused on minimizing the entrainment of sediment into the Project works and Connecticut River during drawdowns or dewatering activities. FirstLight did not propose other operational changes or physical modifications.

As proposed in the Final Report and in response to a December 16, 2016 comment letter from the USEPA, FirstLight has prepared the enclosed protocols to be followed in the event of a dewatering to minimize the potential for the release of excess sediment to the Connecticut River. FirstLight has provided these dewatering protocols to MADEP, USEPA, and FERC staff and may update them periodically as needed to reflect changes in site conditions, new technologies, or otherwise.

[1] In addition to the Sediment Management Plan, FirstLight also developed a Quality Assurance Project Plan (QAPP) in June 2012 at the USEPA's request. The QAPP was subsequently revised in October 2012.

2 BACKGROUND

The Connecticut River is an alluvial river meaning silt and sediment is naturally present within the river channel and is entrained in suspension through normal river dynamics. As noted in the previous section, the Project requires the use of a "lower" and "upper" reservoir as a component of the power generation process. The TFI serves as the Lower Reservoir, with the Upper Reservoir being man-made at the top of Northfield Mountain. During Project operations, silt is drawn into the facility when pumping and accumulates in the Upper Reservoir as it settles out of the water column. As Alden's Upper Reservoir computational hydrodynamic sedimentation modeling demonstrated (conducted for Study No. 3.1.3 and discussed in the Final Report) (Alden, 2014)[2], once sediment is deposited in the Upper Reservoir the sediment generally lies undisturbed.

The results of Study No. 3.1.3 found that during pumping cycles (i.e., up to 4 units operational in pumping mode), there is no practical way to prevent sediment from being transported to the Upper Reservoir. Conversely, the study also found that during generation (i.e., up to 4 units operational in generation mode), Project operations do not cause the release or transport of accumulated sediment from the Upper Reservoir to the Connecticut River. As a result, over time, sediment will accumulate in the Upper Reservoir intake channel and can require periodic removal to ensure that sediments have not accumulated to the point where there is a risk of material discharges of sediment into the Project works and potentially into the Connecticut River in the course of an unwatering (also known as dewatering). In the past, FirstLight has removed this sediment both "hydraulically" (with the Upper Reservoir in use) and in the "dry" (with the Upper Reservoir empty). FirstLight may periodically need to unwater the Upper Reservoir for maintenance and dam safety purposes. Maintenance drawdowns may be planned or unplanned depending on the circumstances.

During a dewatering there are several key physical Project features which help to prevent the release of excessive concentrations of sediment. The first feature is the "check dam" or "stop log structure". The check dam is an approximately 100 ft. long by 10 ft. high reinforced concrete structure spanning the entrance to the Upper Reservoir intake channel, separating the 1,750 foot long intake channel from the main storage area of the Upper Reservoir (Figure 2.1). The purpose of the check dam is to trap sufficient water in the Upper Reservoir to refill the pressure conduit after it has been unwatered and to prevent storm water from draining into the pressure shaft when the Upper Reservoir is unwatered. The check dam also retains sediment that has been accumulated behind the dam so long as sediment accumulation has not exceeded the height of the dam (i.e., 10 feet). As such, so long as the accumulated sediment remains below the height of the check dam, the check dam can reduce the release of excess sediments.

The second key Project feature is the geometry of the 1,750 foot long intake channel. The results of Alden's Upper Reservoir computational hydrodynamic sedimentation model found that during pumping, water and sediment from the Connecticut River are transported at a high velocity through the conduit system to the intake channel leading to the Upper Reservoir. As the water and sediment combine with the water already in the Upper Reservoir intake channel, the wider and deeper intake channel leads to a deceleration of the sediment rich pumped water, which results in the sediment depositing. During generation (i.e., up to four units), the expanded width and depth of the intake channel, combined with the relatively low exit velocity of the water being transported from the Upper Reservoir to the Connecticut River, result in much of the previously deposited sediment remaining in place and not being re-entrained back into the Project works during normal generation (Alden, 2014 [Page 55]). The results of the computational modeling are consistent with the continuous, empirical data collected at the Project tailrace during pumping and generating cycles, which demonstrated no appreciable increase in sediment concentration during generation.

[2] Alden Research Laboratory, Inc. (2014). Engineering Studies of Sedimentation at the Northfield Mountain Project. Holden, MA: FirstLight

Per FirstLight's dewatering procedures, discussed in subsequent sections, the rate of drawdown during a dewatering, and therefore the exit velocity of the water, is essentially the same as, or less than, that which occurs during normal periods of generation. Given this, based on the results of the modeling conducted by Alden (Alden, 2014 [Page 55]), if accumulated sediment is kept below a reasonable threshold in this area (i.e., below the crest of the check dam and of an appropriate thickness and distribution in the intake channel itself), entrainment of sediment in the Project works and the Connecticut River during a dewatering is unlikely as the corresponding velocity is insufficient to mobilize the previously deposited sediment.

The final key Project feature is the physical configuration of the tailrace tunnel. During a dewatering, water exits the Upper Reservoir through the intake channel, into the pressure conduit, through the turbines and draft tubes, into the tailrace tunnel and out through the tailrace exit structure to the Connecticut River. From the draft tubes, the tailrace tunnel runs nearly flat (downward slope of 0.4% for approximately 4,300 ft. or 0.8 miles) and then slopes upward at 12% for approximately 900 ft. or 0.2 miles where it then discharges to the Connecticut River. Figure 2.2 depicts the Project works described above. Due to the length and configuration, it is anticipated that the vast majority of any sediment transported through the pressure conduit and turbines during a dewatering will settle out and deposit in the mile long tailrace tunnel where it will either (1) be transported back to the Upper Reservoir during the next pumping cycle; (2) remain undisturbed; or (3) be removed during Project maintenance activities.

This is consistent with what was observed during the 2010 drawdown, when the shape and configuration of the tunnel, combined with the other factors discussed earlier in this section, resulted in minimal release of sediment to the Connecticut River during the drawdown even though a large amount of sediment had accumulated in the Project Works including the tailrace tunnel. It was not until sediment was being removed from the tailrace tunnel that excessive sediment concentrations were released to the Connecticut River. Issues associated with sediment removal from the tailrace tunnel during the 2010 dewatering have since been addressed and will not be repeated in the future.

The combination of the key Project features discussed above, the rate at which the Upper Reservoir is drawn down and the corresponding velocities, and maintaining the amount of accumulated sediment in the Upper Reservoir intake channel below a certain threshold minimizes the risk of excessive sediment releases during a dewatering. Based on the results of Study No. 3.1.3, FirstLight has focused its measures to minimize the risk of excessive sediment concentrations during a dewatering on ensuring the check dam remains effective and that the amount of accumulated sediment in the intake channel remains below a predetermined threshold. This document describes those measures in more detail.

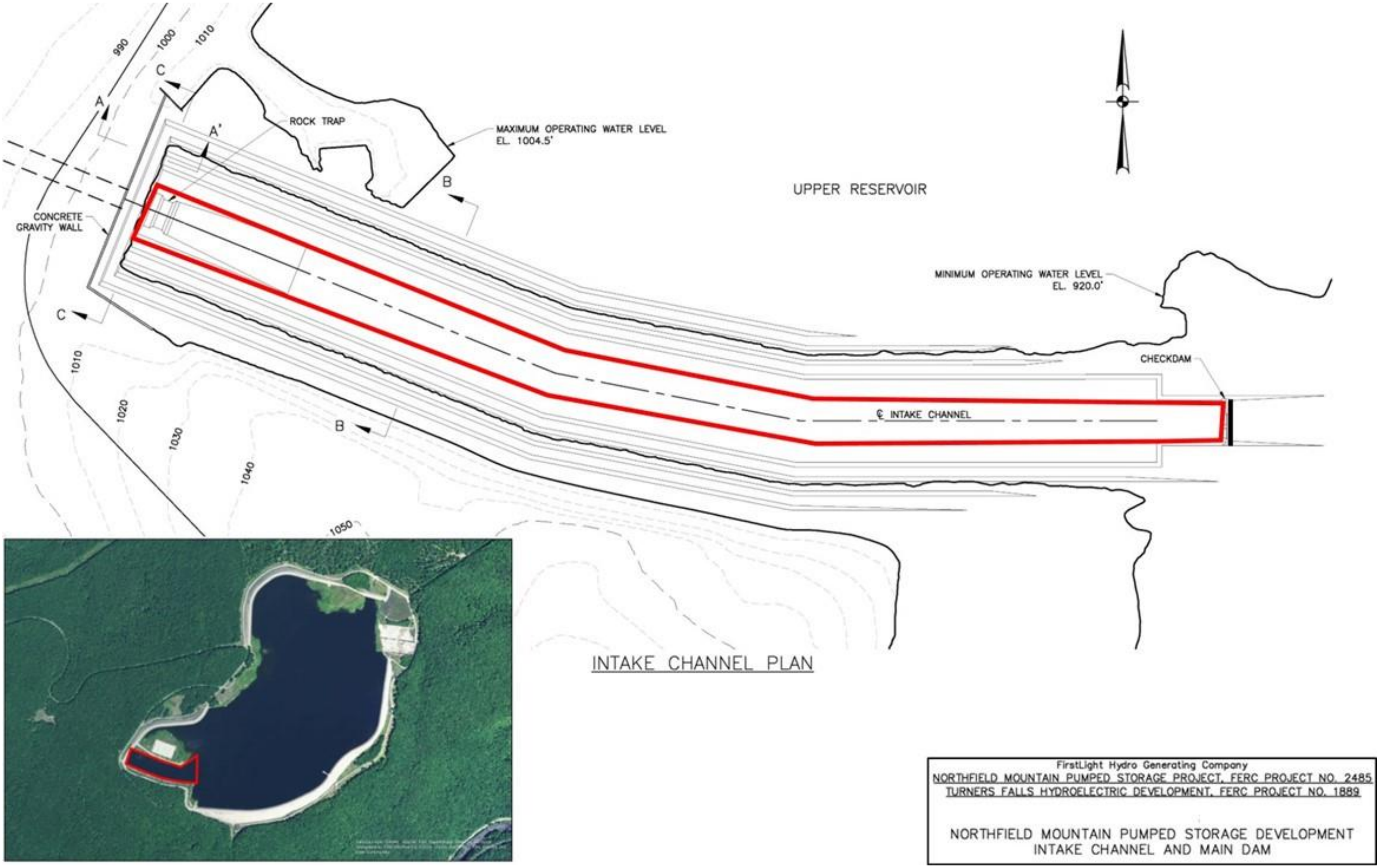


Figure 2.1: Upper Reservoir Intake Channel and Check Dam

POWERHOUSE AND WATER CONDUITS

FirstLight Hydro Generating Company

NORTHFIELD MOUNTAIN PUMPED STORAGE PROJECT, FERC PROJECT NO. 2485

NORTHFIELD MOUNTAIN PUMPED STORAGE DEVELOPMENT
SECTION – POWERHOUSE AND WATER CONDUITS

250' 0 250' 500'

3 MINIMIZING THE RISK OF EXCESSIVE SEDIMENT RELEASES DURING DEWATERING EVENTS

Consistent with the proposals made in the Final Report, the USEPA's letter dated December 15, 2016, notes that FirstLight must develop "…*a plan and procedures to prevent the release of excessive concentrations of sediment during dewatering events.*" In response to this requirement, FirstLight will actively monitor and manage the amount of sediment which accumulates in the Upper Reservoir, with special emphasis on the intake channel and the area in the vicinity of the check dam, to ensure that sediment accumulates at appropriate levels. The steps to prevent the release of excessive sediment during a dewatering event are discussed below.

Bathymetric Surveys

As described in the Final Report, to monitor the amount of sediment accumulation occurring throughout the Upper Reservoir, FirstLight will retain a qualified bathymetric surveying company to perform bathymetric mapping at least once every two years to help understand the location, volume, and rate of sediment accumulation in the Upper Reservoir. The specific techniques and technologies may evolve over time; however, the present plan for surveys is detailed below.

Bathymetric mapping will be performed by boat and is proposed to occur when the Upper Reservoir is near its normal maximum elevation so the maximum extent of bathymetric data can be obtained. Each survey will utilize a multi-beam echo sounder paired with GPS receiver to ensure comparability between surveys. Horizontal and vertical positioning data will be collected continuously on survey lines at predetermined grid spacing in a north-south and east-west direction. Where feasible, subsequent surveys will be conducted at approximately the same time of year as the initial survey to better predict annual sediment dynamics. If excavation of accumulated sediment were to occur, a survey of the excavated area will be conducted to establish an updated baseline.

Bathymetric data will be post processed and translated into a GIS compatible format for analysis purposes. For all bathymetric mapping conducted, data collected will be compared to previous data to estimate rates of sediment accumulation, depth of sediment, and the volume of accumulated sediment throughout the Upper Reservoir, Upper Reservoir intake channel, and the area in the vicinity of the check dam (which is detectable during bathymetric surveys). The results of the bathymetric surveys will reveal sediment location as well as changes in sediment depth and allow for timely removal decisions to be made. A series of steps will then be used to help determine the appropriate action.

Sediment Removal Determination Process

If the results of the bathymetric survey indicate an average sediment depth throughout the middle of the intake channel (as shown in red in Figure 2.1) of 5 ft. or greater, an internal detailed review by an engineering team will be initiated and planning for future sediment removal will commence. The detailed review will include an evaluation as to whether sediment levels have increased to the point where the check dam and/or intake channel geometry would not be able to prevent an excessive release of sediment to the Connecticut River during an unplanned or planned dewatering. The engineering review team will prepare a report of its findings and recommendations. FirstLight will then notify the appropriate agencies and inform them of the next steps.

Once the 5 ft. threshold has been reached, sediment removal will commence within 3 years unless there is a technical and engineering basis for a longer period of time, which would be submitted to USEPA, MADEP, and FERC for review and comment. After reaching the 5 ft. threshold, and until sediment removal occurs, FirstLight will perform bathymetric surveys and detailed engineering reviews annually.

An average sediment depth of 5 ft. throughout the middle of the intake channel (as shown in red in Figure 2.1) was chosen as the trigger point for two primary reasons. First, the results of the pilot dredge conducted for Study No. 3.1.3, combined with prior professional experience, found that 5 ft. of sediment accumulation represents the minimum amount of sediment necessary for hydraulic dredging to be effective. At sediment depths below this threshold, hydraulic dredging has been found to be less effective due to the fact that hydraulic dredging requires a sufficient depth of sediment into which the dredging head is inserted to function properly.

Secondly, based on the results of the computational modeling conducted for Study No. 3.1.3, exit velocities through the intake channel are insufficient to cause the mobilization and entrainment of bed sediment during typical periods of generation (i.e., up to 4 units) (Alden, 2014 [Page 55]). Given that the rate of drawdown, and therefore the velocity, during a dewatering is equal to or less than that of normal generation, it is anticipated that accumulated sediment will remain undisturbed on the bed of the intake channel. By maintaining an average sediment depth of 5 ft. or less throughout the middle of the intake channel, FirstLight believes it will have minimized the risk of excessive sediment releases during planned or unplanned unwatering while still being able to unwater whenever needed.

If the decision to dredge is made, FirstLight will notify the USEPA, MADEP, and FERC. Best Management Practices (BMPs) to prevent the release of sediment during dredging activities will follow those developed as part of Study No. 3.1.3 (Appendix A); these may be updated over time to reflect advances in techniques or technologies and/or to respond to specific conditions anticipated to be encountered during a specific dredging event. In addition, following each dredging event, FirstLight will review all BMPs and update as needed. In the event that the BMPs are updated, FirstLight will provide the most recent version to USEPA, MADEP, and FERC in advance of future dredging activities. The current estimated upland storage capacity available in the Upper Reservoir area for dredged sediments is approximately 50,000 cubic yards. Future sediment management options for dredged sediments include both the development of additional storage and beneficial reuse. Currently, the sediment stockpiled during the 2015 pilot dredge project is being removed from the Project for beneficial reuse.

Figure 3.1 depicts a summary flow chart detailing the decisions and steps involved to prevent the release of excessive sediment concentrations during a dewatering. The steps outlined above, combined with the physical characteristics of the Project works discussed in Section 2 and the dewatering protocols discussed in Section 4, will minimize the risk of excessive sediment releases to the Connecticut River during a planned or unplanned unwatering.

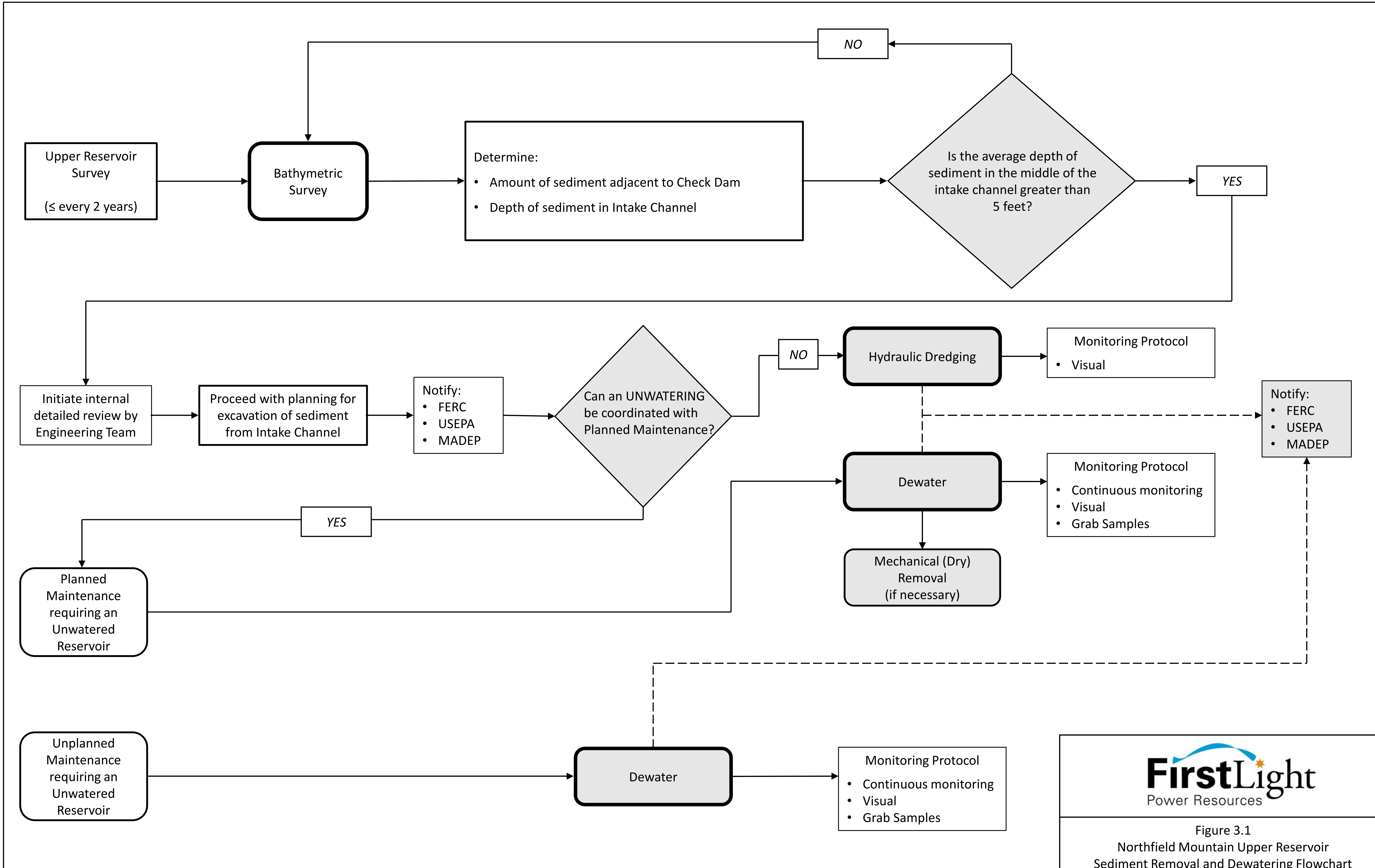


Figure 3.1
Northfield Mountain Upper Reservoir
Sediment Removal and Dewatering Flowchart

4 DEWATERING PROTOCOLS

As discussed in Section 2, there are typically two types of dewatering's which may occur at the Project, those for planned maintenance and those for unplanned maintenance. Planned maintenance may include repair of powerhouse electrical or hydraulic equipment, inspection of the Upper Reservoir dams and dikes, and repair of intake structures. A planned maintenance dewatering may also include sediment removal using traditional excavation equipment. Conversely, if conditions should arise such that the security or safety of the Project is at risk, FirstLight may require an unplanned dewatering of the Upper Reservoir. Under this scenario, FirstLight would follow the normal dewatering protocol to the extent possible but notify the appropriate agencies as soon as practical.

It should be noted that in the Final Report, FirstLight committed to developing two types of dewatering protocols, one for an emergency and one for maintenance or other. As a result of the sediment management measures discussed in Section 3 (i.e., maintaining the amount of accumulated sediment at a stable level at all times), FirstLight has minimized the risk of excessive sediment releases during planned or unplanned dewatering. As such, separate dewatering protocols are no longer needed as originally discussed in the Final Report.

4.1 Dewatering Protocols

Normal dewatering of the Upper Reservoir is a complicated process and includes steps to minimize the risk of damage to equipment, conduits, and structures and to prevent the entrainment of sediment into the Project works that could result in deposition in the Connecticut River. Typically, dewatering the Upper Reservoir takes 7-10 days due to the slow rate of drawdown and complexity of the process. In case of an emergency drawdown for safety reasons, it may be deemed necessary to advance the process as quickly as possible to reduce exposure to the public or potential for equipment damage.

Once the decision to dewater has been made, FirstLight will notify the appropriate agencies as discussed in Section 4.3. Operationally, FirstLight will begin the drawdown process utilizing all four units until a certain Upper Reservoir water surface elevation is reached. As the Upper Reservoir water surface level decreases, FirstLight will reduce the number of units from four to three, three to two, and two to one after which the dewatering process will transition to a slow drain. The rate of which the Upper Reservoir is drawn down, as well as the corresponding exit velocity of the water, will be equal to or less than that which occurs during normal Project operations. For the reasons discussed in the preceding sections (i.e., intake channel geometry and corresponding water velocities, configuration of Project works, and the amount of accumulated sediment in the intake channel), FirstLight does not anticipate the release of excessive sediment concentrations during this process.

Once the Upper Reservoir has been successfully unwatered, tailrace stop logs will be put in place to seal off the tailrace tunnel from the TFI. A series of sump pumps will then be utilized to remove water present within the tailrace tunnel. The sump pumps are connected to an independent pipe which eventually runs to the surface before discharging to a drainage swale in the vicinity of the Riverview Picnic area, located just upstream of the Project tailrace; the drainage swale discharges to the Connecticut River. It is anticipated that any sediment pumped to the drainage swale would be a de minimis amount; however, FirstLight will monitor the discharge and, if necessary, install a silt curtain, or implement other similar sediment retention strategies, at the drainage swale during the pumping of the water from the tailrace tunnel.

FirstLight will monitor turbidity or suspended sediment concentration (SSC) levels in the tailrace and mainstem TFI over the course of the dewatering as discussed in the next section.

4.2 Monitoring

FirstLight will employ a three-tiered approach to suspended sediment or turbidity monitoring during a dewatering including: (1) visual monitoring; (2) continuous monitoring; and (3) grab sample collection and laboratory analysis. Each monitoring component is discussed in greater detail below.

Visual Monitoring

FirstLight shall perform visual monitoring during daylight hours of the area adjacent to the Upper Reservoir intake channel and tailrace area. If increased turbidity is observed (i.e., water exiting the tailrace that appears to be more turbid than the TFI), the continuous monitoring data (see below) will be reviewed to determine if turbidity levels have risen to a point that the dewatering procedure should stop.

Continuous Monitoring

Continuous turbidity monitors, or similar technology, will be deployed in the tailrace and at an appropriate location along the TFI just upstream of the tailrace for the duration of the dewatering. Data will either be transmitted directly to the Project's SCADA system or be offloaded and reviewed at the beginning and end of each day as well as every two hours during normal business hours. In the event that visual monitoring indicates an increase in turbidity and (1) turbidity readings from the tailrace monitor are two times greater than those observed at the mainstem monitor or (2) turbidity levels measured at the tailrace monitor exceed 25 NTU, whichever is greater, for two hours, FirstLight shall investigate and correct the cause of the turbidity.

It should be noted that in its December 15, 2016 letter, the USEPA noted that FirstLight should deploy the suspended sediment monitors used for Study No. 3.1.3 to monitor suspended sediment concentrations during a dewatering. Due to the extensive issues encountered using the suspended sediment monitors during Study No. 3.1.3 (as detailed in the Final Report), FirstLight has instead elected to propose the monitoring approach detailed above.

Laboratory Analysis of Grab Samples

In advance of a non-emergency dewatering, FirstLight will collect grab samples in the tailrace and at an appropriate location along the TFI just upstream of the tailrace to conduct calibration testing of the continuous monitoring equipment described above. Grab samples will be submitted to a qualified laboratory for analysis. Results will then be compared to the data collected by the continuous monitors.

4.3 Agency Consultation / Notification

Should FirstLight choose to perform a non-emergency dewatering, it will follow this protocol unless an updated protocol has been submitted to reflect changes in site conditions, new technologies, or otherwise. FirstLight will notify MADEP, USEPA, and FERC in advance to document the specific plan and provide BMPs. FirstLight will comply with all applicable federal, state, and local regulations. Under emergency conditions, FirstLight will take immediate measures to protect human health and safety or property and notify the appropriate agencies as soon as practical and in any event within 2 hours of beginning those measures.

4.4 Protocol Review and Update

FirstLight shall review this protocol, at a minimum, after each dewatering event and provide revisions to the agencies listed in Section 4.3, as necessary. The intent of subsequent revisions is to improve the usefulness of the protocol by incorporating best practices learned from each event.

APPENDIX A – DREDGING BEST MANAGEMENT PRACTICES

Potential Pilot Dredging Project
Best Management Practices

Northfield Mountain Pumped Storage Project FERC Project No. 2485-063

Prepared For:

FirstLight Power Resources

GDF SUEZ

99 Millers Falls Road
Northfield, MA 01360

Prepared By:

New England Environmental, Inc.
Environmental Consulting
15 Research Drive
Amherst, MA 01002
(p) 413.256.0202
6 Way Road, Suite 214
Middlefield, CT 06455
(p) 860.316.2001
www.neeinc.com

DOUCET & ASSOCIATES
136 West Street, Suite 103
Northampton, MA 01060
O: 413-517-0133
F: 800-587-2817
www.doucetengineers.com

Date:

February 24, 2015

Table of Contents

FIGURES

1.0 INTRODUCTION

New England Environmental, Inc. (NEE) and Doucet & Associates, Inc. (Doucet) have prepared this Best Management Practices (BMP) Manual on behalf of FirstLight Power Resources Services, LLC (FirstLight), an agent for FirstLight Hydro Generating Company, an affiliate of GDF SUEZ Energy North America, Inc., for the Northfield Mountain Pumped Storage Project Pilot Dredge Program. This document sets forth BMPs to minimize the risk of adverse impacts to the Upper Reservoir and the Connecticut River due to sediment extraction and storage associated with the dredging operation. The BMPs and procedures included in this plan were developed in consultation with the Massachusetts Department of Environmental Protection (MADEP) and the United States Environmental Protection Agency (USEPA).

It is FirstLight's policy that all construction, operation and maintenance activities be conducted in a safe manner that minimizes impacts on stream and wetlands, wildlife habitat, cultural resources and the human environment. The objective of this Manual is to provide FirstLight's personnel and contractors with the information necessary to perform the dredging activities while minimizing project impacts. FirstLight will meet these objectives by employing the BMPs contained in this Manual. In general, the BMPs are designed to minimize erosion and sedimentation by:

- Minimizing the extent and duration of soil exposure
- Protecting critical areas by reducing the velocity of water and redirecting runoff
- Installing erosion and sediment control BMPs
- Monitoring and maintaining BMPs as necessary throughout the dredging and sediment management activities
- Complete the dredging and sediment management activities in a safe and timely manner

2.0 PROJECT DESCRIPTION

Deep water hydraulic dredging of the Upper Reservoir will be employed as a mechanism to avoid the entrainment of accumulated silt into the intake and ultimately the Connecticut River at harmful levels during operational activities. One of the advantages of deep water hydraulic dredging is that it can occur while the Project is available for generation or pumping, which allows for removal of sediments without the need for removing the Project from service. In contrast, other mechanical means of sediment removal may require dewatering of the Upper Reservoir and would likely require an extended outage.

Because the dredging could occur during generation, BMPs will be implemented prior to, during and post any dredging to avoid sediment migration from the Upper Reservoir through the Project and the Connecticut River.

Dredging of the Upper Reservoir will include the preparation of a staging area. The staging area would receive a slurry of suspended sediment and water pumped from the hydraulic dredge to geotubes. In the staging area, solids are separated from water and collected for processing and removal.

The existing peninsula north of the intake channel will be used for staging. Within this area, dredged material will be processed. The land area required for this is approximately 130,000 square feet. The design of the staging area includes enough workspace for daily operations while allowing for containment of materials.

Before the tubes are pumped into, a manifold piping system will be setup surrounding the tube area. This system of pipes and valves will feed the tubes with the combined sediment and water mixture removed from the lake bottom. In order to keep the tubes stable each tube will be secured to the adjacent tube using the manufactured ties built into the tubes. Each of the outside tubes will be secured to stakes driven into the ground around the perimeter of the staging area. Once the piping system is setup, which would include a polymer injection system, pumping can begin.

3.0 SITE DESCRIPTION

The Northfield Mountain Pumped Storage Project (Project No. 2485) is a 1,143-MW pumped storage project located along the east bank of the Connecticut River in the Towns of Northfield and Erving, MA.

The Project began commercial operation in 1972 and consists of an underground powerhouse, four reversible pump-turbine generators, an underground pressure shaft, four unit penstocks and draft tubes, and a mile-long tailrace tunnel connecting the powerhouse to a 20-mile-long reach of the Connecticut River known as the Turners Falls Impoundment, which serves as the lower reservoir. The manmade upper reservoir (Upper Reservoir) was formed with four earth-core rock fill embankment structures and a concrete gravity dam.

The plant's operation does not affect the river water temperature and is nonpolluting. Power from the plant is quickly available to help maintain system reliability in emergencies or to help meet peak power requirements of over 1.7 million electric customers.

The dredging will occur in an approximately 300 feet by 600 feet section of the Upper Reservoir.

4.0 BEST MANAGEMENT PRACTICES (BMPs)

Erosion occurs whenever water, wind or other forces, such as gravity, remove soil materials. Sedimentation occurs when these materials are deposited in low-lying areas, such as waterbodies and wetlands. The potential for erosion and sedimentation increases during periods of soil exposure and thus are more susceptible to erosion.

FirstLight prepared this BMP Manual to describe measures to be utilized to minimize erosion of disturbed soils and transportation of sediments during the Northfield Mountain Pumped Storage Project Pilot Dredge Program. The procedures developed in this Manual are designed to accommodate varying field conditions while maintaining rigid minimum standards for the protection resources.

This Manual is designed to provide specifications for the installation and implementation of soil erosion and sediment control measures while allowing adequate flexibility to use the most appropriate measures based on site-specific conditions.

The following descriptions are meant to be used in conjunction with the Project Drawings showing the proposed plan for management of sediment on site. There may also be additional measures required based on site activities which would be implemented as the project proceeds.

4.1 Stabilized Construction Exit

Applications:

- A temporary stone stabilized pad located at points of vehicular ingress and egress on a work site.
- Provides a stable entrance and exit from a site in order to keep mud and sediment off public roads and other paved areas.

Advantages:

- Mud and sediment on vehicle tires is significantly reduced which avoids hazards caused by depositing mud on the public roadway and other paved areas.
- Sediment, which is otherwise contained on the construction site, does not enter stormwater runoff elsewhere.

Limitations:

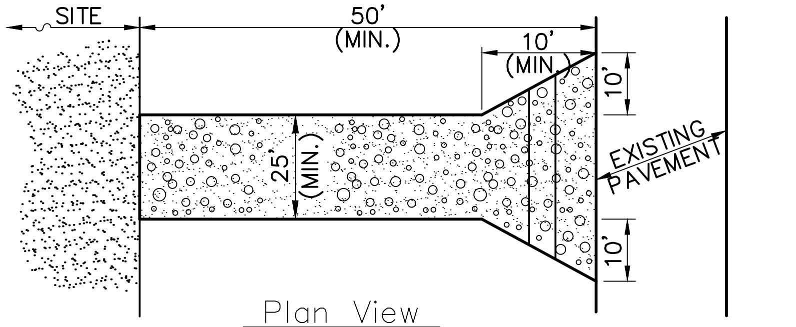
- This practice will only be effective if sediment control is used throughout the rest of the site.

Considerations:

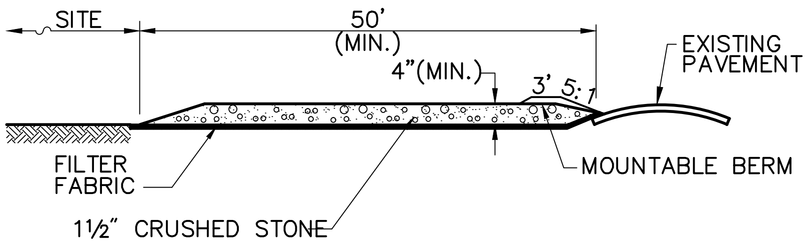
- Avoid locating at curves in public roads or on steep slopes.
- If the action of the vehicle travelling over the gravel pad is not sufficient to remove the majority of the mud, then the tires may need to be washed before entering a public roadway or other paved areas.
- If washing is used, provisions must be made to intercept the wash water and trap the sediment before it is carried off-site. Construction entrances should be used in conjunction with the stabilization of construction roads to reduce the amount of mud picked up by vehicles.

Maintenance:

- The entrance should be maintained in a condition that will prevent tracking or flowing of sediment onto public rights-of-way. This may require periodic topdressing with additional stone.
- Remove mud and sediment tracked or washed onto public roads.
- Mud and soil particles will eventually clog the voids in the gravel and the effectiveness of the gravel pad will not be satisfactory. When this occurs, the pad should be topdressed with new stone. Complete replacement of the pad may be necessary when the pad become completely clogged.
- If washing facilities are used, the sediment traps should be cleaned out as often as necessary to assure that adequate trapping efficiency and storage volume is available.
- All temporary erosion and sediment control measures shall be removed within 30 days after final site stabilization is achieved or after the temporary practices are no longer needed. Trapped sediment shall be removed or stabilized onsite. Disturbed soil areas resulting from removal shall be permanently stabilized.



Plan View



Cross-section

Notes:

1. ENTRANCE WIDTH SHALL BE A TWENTY-FIVE (25) FOOT MINIMUM, BUT NOT LESS THAN THE FULL WIDTH AT POINTS WHERE INGRESS OR EGRESS OCCURS.
2. THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH SHALL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHTS-OF-WAY. THIS MAY REQUIRE PERIODIC TOP DRESSING WITH ADDITIONAL STONE AS CONDITIONS DEMAND AND REPAIR OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO PUBLIC RIGHTS-OF-WAY MUST BE REMOVED IMMEDIATELY. BERM SHALL BE PERMITTED. PERIODIC INSPECTION AND MAINTENANCE SHALL BE PROVIDED AS NEEDED.

SOURCE: DOUCET & ASSOCIATES, INC.

SCALE:
NOT TO SCALE

Stabilized Construction Exit

2/6/03
SED-9

4.2 Construction Road Stabilization

Applications:

- Stabilization of temporary access routes, on-site vehicle transportation routes, and construction parking areas to control erosion.

Advantages:

- Proper grading and stabilization of construction roads and parking areas reduces erosion and minimizes dust problems.
- Road stabilization can significantly speed on-site work, avoid instances of immobilized machinery and delivery vehicles, and generally improve site efficiency and working conditions during adverse weather.

Limitations:

- Measures on temporary roads must be cost-effective not only to install but also to remove.
- May require maintenance to replace aggregate or repair ruts.

Considerations:

- Avoid steep slopes, excessively wet areas, and highly erodible soils.
- Controlling surface runoff from the road surface and adjoining areas is a key erosion control consideration. Provide surface drainage and divert excess runoff to stable areas.
- Areas which are graded for vehicle transport and parking purposes are especially susceptible to erosion. The exposed soil surface is continually disturbed, leaving no opportunity for vegetative stabilization. Such areas also tend to collect and transport runoff waters along their surfaces. During wet weather, they often become muddy which generate significant quantities of sediment that may pollute nearby streams or be transported off-site on the wheels of vehicles.

Maintenance:

- Inspect stabilized areas regularly, especially after large storm events. Add crushed rock if necessary and restabilize any areas found to be eroding.
- All temporary erosion and sediment control measures should be removed within 30 days after final site stabilization is achieved or after the temporary practices are no longer needed.
- Trapped sediment should be removed or stabilized on site. Disturbed soil areas resulting from removal should be permanently stabilized.

4.3 Timber Mats

Applications:

- Used for access where the ground surface is unstable due to saturated soils or other substrates not suitable for heavy vehicles.

Advantages:

- Prevents rutting of unstable ground surfaces.

Limitations:

- Only for temporary use.
- Need to be installed with heavy machinery.
- Equipment operators must remain cautious to not drive or slip off the mats.

Considerations:

- Should be placed along the travel area so that the individual boards are resting perpendicular to the direction of traffic. No gaps should exist between mats.
- Should be removed one at a time by backing out of the site. Upon removal of mats, the soil surface should be re-graded and stabilized as necessary.

Maintenance:

- Should be cleaned after use to remove any invasive plant species.
- In winter, mats must be plowed, sanded or heated to prevent equipment from sliding off mats.

4.4 Silt Fence

Applications:

- A silt fence is a temporary sediment barrier consisting of a filter fabric stretched across and attached to supporting posts and entrenched. The silt fence is constructed of stakes and synthetic filter fabric.
- A silt fence intercepts and detains small amounts of sediment from disturbed areas and reduces runoff velocity.
- Applicable where erosion would occur in the form of sheet erosion.

Advantages:

- Removes sediments and prevents downstream damage from sediment deposits.
- Reduces speed of runoff flow.
- Minimal clearing and grubbing required for installation.
- Silt fences trap a much higher percentage of suspended sediments than hay/straw bales.

Limitations:

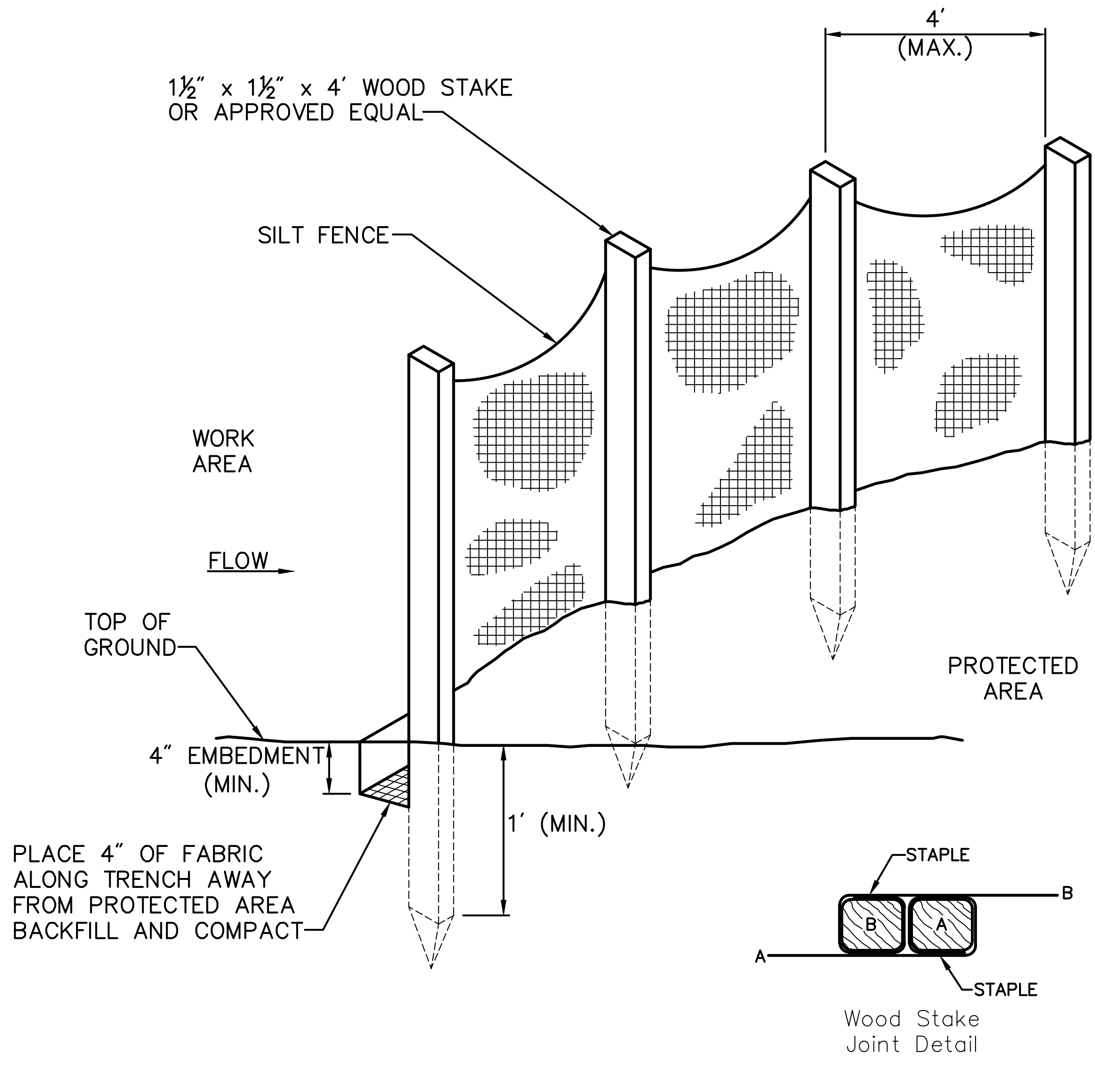
- Silt fences are not practical where large flows of water are involved. Their use is recommended only for small drainage areas, and flow rates of less than 0.5 cfs.
- Flow should not be concentrated.
- Problems may arise from improper installation.

Considerations:

- Silt fences have a low permeability to enhance sediment trapping. This may create ponding behind the silt fence.

Maintenance:

- Silt fences should be inspected after each rainfall and at least daily during prolonged rainfall. Repair as necessary.
- Remove sediment deposits promptly to provide adequate storage volume for the next storm event and to reduce pressure on the fence. Take care to avoid undermining the fence during cleanout.
- If the fabric tears, decomposes, or in any way becomes ineffective, replace it immediately.
- Remove all fencing materials after the contributing drainage area has been properly stabilized. Sediment deposits remaining after the fence has been removed should be graded to conform with the existing topography and vegetated.



SOURCE: DOUCET & ASSOCIATES, INC.

SCALE:
NOT TO SCALE

Silt Fence Barrier

2/6/03
SED–1

4.5 Straw Bale

Applications:

- A temporary sediment barrier consisting of a row of entrenched and anchored straw bales. Used to intercept and detain small amounts of sedimentation from disturbed areas of limited extent to prevent sediment from leaving the site. Decreases the velocity of sheet flows and low-to-moderate level channel flows.
- Downslope of disturbed areas.

Advantages:

- When properly used, straw bale barriers are an inexpensive method of sediment control.

Limitations:

- Straw bale barriers are easy to misuse.
- Straw bale barriers require more maintenance than silt fence barriers and permeability through the bales is slower.

Considerations:

- Straw bale barriers are used similarly to silt fence barriers; especially where the area below the barrier is undisturbed and vegetated.
- Straw bales should be located where they will trap sediment.
- Straw bales should be placed in a single row, lengthwise on the contour, with ends of adjacent bales tightly abutting one another.
- Straw bales should 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.
- The barrier should be entrenched and backfilled. A trench should be excavated the width of a bale and the length of the proposed barrier. The trench must be deep enough to remove all material which might allow underflow.

Maintenance:

- Straw bale barriers should be inspected immediately after each runoff-producing rainfall and at least daily during prolonged rainfall.
- Close attention should be paid to the repair of damaged bales, undercutting beneath bales, and flow around the end of bales.
- Necessary repairs to barriers or replacement of bales should be accomplished promptly.
- Sediment deposits should be checked after each runoff-producing rainfall. They must be removed when the level of deposition reaches approximately one-half the height of the barrier.

4.6 Erosion Control Blanket

Applications:

- Porous fabrics used to stabilize the flow in channels/swales and to stabilize slopes subject to the forces of erosion.

Advantages:

- A wide variety of materials are available to match specific needs.
- Fabrics are relatively inexpensive.

Limitations:

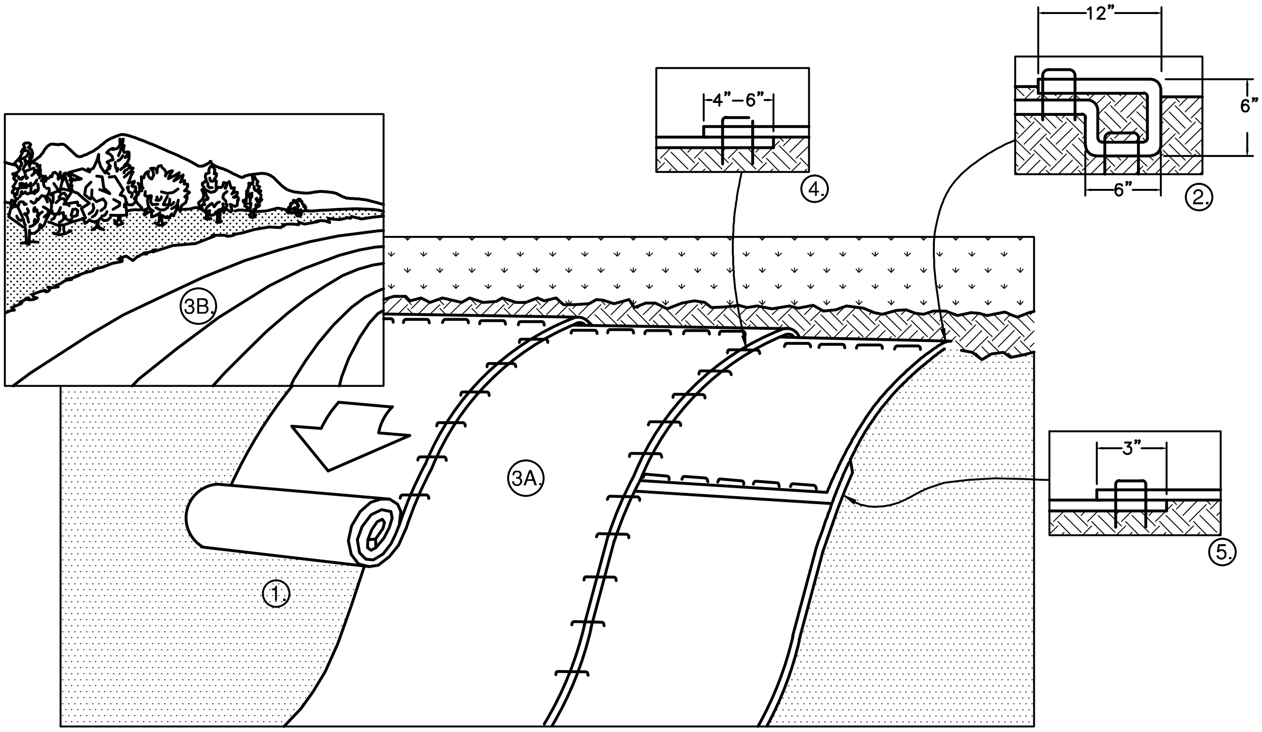
- If the fabric is not properly selected, designed, or installed, the effectiveness may be reduced.
- Many synthetic geotextiles are sensitive to light and must be protected prior to installation.

Considerations:

- Effective netting and matting require firm, continuous contact between the materials and the soil. If there is no contact, the material will not hold and erosion will occur underneath the material.

Maintenance:

- There are numerous types of geotextiles available, therefore the selected fabric should match its purpose. In the field, important concerns include regular inspections to check for cracks, tears, or breaches in the fabric.



Installation

1. PREPARE SOIL BEFORE INSTALLING BLANKETS, INCLUDING ANY NECESSARY APPLICATION OF LIME, FERTILIZER, AND SEED

2. BEGIN AT THE TOP OF THE SLOPE BY ANCHORING THE BLANKET IN A 6" DEEP X 6" WIDE TRENCH WITH APPROXIMATELY 12" OF BLANKET EXTENDED BEYOND THE UP–SLOPE PORTION OF THE TRENCH AS SHOWN IN DETAIL

3. ANCHOR THE BLANKET WITH A ROW OF STAPLES/STAKES APPROXIMATELY 12" APART IN THE BOTTOM OF THE TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING. APPLY SEED TO COMPACTED SOIL AND FOLD REMAINING 12" PORTION OF BLANKET BACK OVER SEED AND COMPACTED SOIL. SECURE BLANKET OVER COMPACTED SOIL WITH A ROW OF STAPLES/STAKES SPACED APPROXIMATELY 12" APART ACROSS THE WIDTH OF THE BLANKET.

4. ROLL THE BLANKETS (A.) DOWN OR (B.) HORIZONTALLY ACROSS THE SLOPE. BLANKETS WILL UNROLL WITH APPROPRIATE SIDE AGAINST THE SOIL SURFACE. ALL BLANKETS MUST BE SECURELY FASTENED TO SOIL SURFACE BY PLACING STAPLES/STAKES IN APPROPRIATE LOCATIONS AS PER MANUFACTURES RECOMMENDATION.

5. THE EDGES OF PARALLEL BLANKETS MUST BE STAPLED WITH MINIMUM 6" OVERLAP. TO ENSURE PROPER SEAM ALIGNMENT, PLACE THE EDGE OF THE OVERLAPPING BLANKET (BLANKET BEING INSTALLED ON TOP) EVEN WITH THE SEAM STITCH ON THE PREVIOUSLY INSTALLED BLANKET.

6. CONSECUTIVE BLANKETS SPLICED DOWN THE SLOPE MUST BE PLACED END OVER END (SHINGLE STYLE) WITH AN APPROXIMATE 3" OVERLAP. STAPLE THROUGH OVERLAPPED AREA, APPROXIMATELY 12" APART ACROSS ENTIRE BLANKET WIDTH.

7. PLACE STAPLES/STAKES PER MANUFACTURER'S RECOMMENDATION FOR THE APPROPRIATE SLOPE BEING APPLIED.

Notes:

1. IN LOOSE SOIL CONDITIONS, THE USE OF STAPLE OR STAKE LENGTHS GREATER THAN 6" MAY BE NECESSARY TO PROPERLY SECURE THE BLANKETS.

2. FOLLOW EROSION CONTROL TECHNOLOGY COUNCIL SPECIFICATION FOR PRODUCT SELECTION.

SOURCE: DOUCET & ASSOCIATES, INC.

SCALE: NOT TO SCALE

Erosion Control Blanket Slope Installation

11/1/07

SED–8

4.7 Vegetated Filter Strip

Applications:

- A vegetated filter strip is an area of vegetation for runoff to flow through before it leaves a disturbed site or enters into a designated drainage system.
- This practice applies to sites where adequate vegetation can be established and maintained. Vegetative filter strips can be used effectively:
  - Adjacent to water courses such as waterways and diversions and waterbodies such as streams, ponds, and lakes.
  - At the outlet of stormwater management structures.
  - Along the top and at the base of slopes.
- A vegetative filter strip is designed to provide runoff treatment of conventional pollutants, but not nutrients. This practice is not designed to provide streambank erosion control.

Advantages:

- It improves water quality by removing sediment and other pollutants from runoff as it flows through the filter strip. Some of the sediment and pollutants are removed by filtering, absorption, adsorption and settling as the velocity of flow is reduced.

Limitations:

- A vegetative filter strip should not be used for conveyance of larger storms because of the need to maintain sheet flow conditions.
- If the flow becomes concentrated in rills, the effectiveness of the strip is greatly reduced.

Considerations:

- Filter strips may occur naturally or be constructed . It is important that filter strips be designed and constructed so that runoff flows uniformly across the filter strip as sheet flow.
- Natural filter areas can provide excellent pollutant removal, particularly those areas left adjacent to natural water courses and bodies of water. It is also important to evenly distribute the runoff into these natural areas for best performance.
- To prevent soil compaction, no equipment should be allowed to operate within the filter strip area. Uncompacted soil encourages percolation and minimizes rapid surface runoff.

Maintenance:

- Filter strips should be maintained as natural areas once the vegetation is established. The filter strip should be protected from damage.
- The filter strip should be inspected periodically and after every major rainstorm to determine if the entrance conditions are still uniform and level and to see if rills have formed. Any problem areas should be repaired promptly to prevent further deterioration.

4.8 Grassed Waterway

Applications:

- A natural or constructed waterway or outlet shaped or graded and established in suitable vegetation as need for the safe disposal of runoff water. Used to convey and dispose of concentrated runoff to a stable outlet without damage from erosion, deposition, or flooding.
- This practice applies to sites where:
    - Concentrated runoff will cause damage from erosion or flooding.
    - A vegetated lining can provide sufficient stability for the channel cross section and grade.
    - Slopes are generally less than 5 percent.
    - Typical uses include roadside ditches and outlets for diversions.

Advantages:

- Vegetated swales reduce runoff velocities and reduce potential erosion from the discharge of runoff.
- Vegetated swales may also remove some particulate pollutants from stormwater runoff and increase infiltration.

Limitations:

- Vegetation should be established before runoff is allowed to flow in the waterway.
- During the initial establishment period, flow should be diverted out of the channel if possible to allow for a good stand of grass. If this is not possible use matting.

Considerations:

- Grass-lined channels resemble natural systems and are usually preferred where design velocities are suitable.
- Adequate capacity and sufficient erosion resistance must be considered.

Maintenance:

- During the establishment period, the channel should be checked after every rainfall to determine if the grass is in good condition.
- After the vegetation has become established, the channel should be checked periodically and after every major storm to see if damage has occurred. Any damaged areas should be repaired and revegetated immediately.
- Maintenance of the vegetation in the grassed waterway is extremely important in order to prevent rilling, erosion, and failure of the waterway.
- Mowing should be done frequently enough to control encroachment of weeds and woody vegetation and to keep the grasses in a vigorous condition. The vegetation should not be mowed too closely so as to reduce the erosion resistance in the waterway.
- Remove all significant sediment and debris from channel to maintain the design cross section and grade and prevent spot erosion.

4.9 Silt Curtain

Applications:

- A silt curtain is a temporary sediment barrier installed in a waterbody to contain sediment and prevent the pollution and degradation of waters outside the work areas.

Advantages:

- A silt curtain will contain coarse sediment suspended in water to the work area.

Limitations:

- A silt curtain will not keep water from being muddy during work activities.

Considerations:

- The silt curtain should obstruct the flow as little as possible to reduce the chance of failure.

Maintenance:

- Accumulated sediment must be removed periodically. The curtain must be inspected often. Any damage must be immediately repaired.

4.10 Rock Lined Channel

Applications:

- Rock lined swales are conveyance systems designed, shaped, and lined to convey water in a non-erosive manner.
- Suitable in systems which collect, concentrate, and Convey water at the ground surface.

Advantages:

- Reduce velocities and filter runoff.
- Convey water in a non-erosive manner.

Limitations:

- Converts sheet flow to channel flow, which may increase flow velocities and erosive energy.
- Concentrates the volume of runoff.

Considerations:

- Ensure the swale has sufficient capacity to convey water and is also resistant to erosion during peak flows.
- Determine the capacity of the swale and the velocity of flow from the type of lining, cross-sectional areas and shape, and slop of the swale.
- Use rock lined swales to withstand high velocities (3-10 feet per second), using larger rock for greater flow velocities. Consider incorporating check dams into the swale system at regular intervals to encourage sedimentation where high rates of sedimentation occur.

Maintenance:

- Inspect for dislodged or unstable rocks and any erosion and undercutting, especially along swale bottom and adjacent slopes. Repair as necessary.
- Monitor ongoing effectiveness and determine if another BMP (i.e., check dam) could improve long-term effectiveness.
- If accumulated material has decreased swale capacity, removal of accumulated material is necessary.

4.11 Mulching Exposed Soil Surfaces

Applications:

- Applying a blanket of straw to the soil surface to provide immediate protection to exposed soils.
- In areas that have been seeded either for temporary or permanent cover, mulching should immediately follow seeding.
- Areas which cannot be seeded because of the season, or are otherwise unfavorable for plant growth.

Advantages:

- Mulching offers instant protection to exposed areas.
- Mulches conserve moisture and reduce the need for irrigation.
- Mulching does not require removal; seeds can grow through.
- It's one of the most effective and economical erosion control practices.

Limitations:

- Care must be taken to apply mulch at the specified thickness, and on steep slopes mulch may need to be supplemented with netting.
- Thick mulches can reduce the soil temperature, delaying seed germination.
- Mulch can be blown or washed away by runoff if not secured.

Considerations:

- Inadequate coverage may result in erosion, washout, and poor plant establishment.
- If an appropriate tacking agent is not applied or applied in insufficient amount, then mulch can be lost to wind and runoff.

Maintenance:

- Inspect after rainstorms to check for movement of mulch or erosion. Repair as necessary.
- Blanket mulch that is displaced by flowing water should be repaired as soon as possible.

4.12 Temporary Seeding

Applications:

- Planting rapid-growing annual grasses, small grains, or legumes to provide initial, temporary cover for erosion control on disturbed areas.
- Temporarily stabilize areas that will exposed for a period of more than 30 working days.
- To stabilize disturbed areas before final grading or in a season not suitable for permanent seeding.
- Temporary seeding controls runoff and erosion until permanent vegetation or other erosion control measures can be established.
- Root systems hold down the soils so that they are less apt to be carried offsite by storm water runoff or wind.
- Temporary seeding also reduces the problems associated with mud and dust from bare soil surfaces during construction.

Advantages:

- Vegetation will not only prevent erosion from occurring, but will also trap sediment in runoff from other parts of the site.
- Temporary seeding offers fairly rapid protection to exposed areas.

Limitations:

- Temporary seeding is only viable when there is a sufficient window in time for plants to grow and establish. It depends heavily on the season and rainfall rate for success.
- If sown on subsoil, growth will be poor unless heavily fertilized and limed. Because overfertilization can cause pollution of stormwater runoff, other practices such as mulching alone may be more appropriate. The potential for overfertilization is an even worse problem in or near aquatic systems.
- Once seeded, areas should not be travelled over.
- Irrigation may be needed for successful growth. Regular irrigation is not encouraged because of the expense and the potential for erosion in areas that are not regularly inspected.

Considerations:

- Temporary seedings provide protective cover for less than one year. Areas must be reseeded annually or planted with perennial vegetation.
- Temporary seeding is used to protect earthen sediment control practices and to stabilize areas that will be exposed for weeks or months. Temporary seeding can provide a nurse crop for permanent vegetation, provide residue for soil protection and seedbed preparation, and help prevent dust production.
- Use low-maintenance native species wherever possible.
- Planting should be timed to minimize the need for irrigation.
- Temporary seeding is effective when combined with phasing so bare areas of the site are minimized at all times.

Maintenance:

- Inspect within 6 weeks of planting to see if stands are adequate. Check for damage after heavy rains.
- Seeds should be supplied with adequate moisture. Furnish water as needed, especially in abnormally hot or dry weather. Water application rates should be controlled to prevent runoff.

4.13 Dewatering Sump

Applications:

- A temporary pit constructed to trap and filter water for pumping into suitable discharge areas.
- When water collects and must be pumped away during excavating, dewatering, maintenance or removal of sediment traps and basins or other areas that collect sediment-laden water and can only be removed by pumping.

Advantages:

- Provides an area from which to dewater and reduce sediment in the discharge.

Limitations:

- The sump pit will become clogged with sediment, oils, and organic matter over time.

Considerations:

- A design is not required for the sump, but consideration should be given to site conditions.

Maintenance:

- It is important to remove material over time to prolong its effectiveness.
- The pit should be checked after every major storm to evaluate its effectiveness. If the pit and filter fabric become plugged with sediment, the pit should be rehabilitated.

4.14 Frac Tank

Applications:

- Can be used in large clean-up operations or simply for temporary storage of water or other liquids.

Advantages:

- They contain a series of baffles that allow fine materials to settle out of the water column.
- Can be used in conjunction with pumps, filters, dewatering units and vacuum boxes as part of a large scale project.
- Can hold 21,000 gallons or more.

Limitations:

- Site specific conditions can limit set-up locations (e.g., slopes, unlevel ground).
- If contents are contaminated, it may require disposal at a regulated facility.

Considerations:

- The use of multiple tanks may be necessary for the management of large volumes.

Maintenance:

- Frac tanks must be monitored to ensure proper functioning.
- Limited onsite maintenance is required.

4.15 Sediment Trap

Applications:

- A sediment trap is formed by excavating a pond or by placing an earthen embankment across a low area or a drainage swale. An outlet or spillway is constructed using large stones or aggregate to slow the release of runoff. The trap retains the runoff long enough to allow silt to settle out.
- To intercept sediment-laden runoff from small disturbed areas (<5 acres) and detains it long enough for the majority of sediment to settle out.

Advantages:

- Reduces sediment deposits downstream.
- Can simplify the design process by trapping sediment at specific spots onsite.

Limitations:

- Effective only if properly maintained.
- Will not remove very fine silts and clays.
- Serves only limited areas.

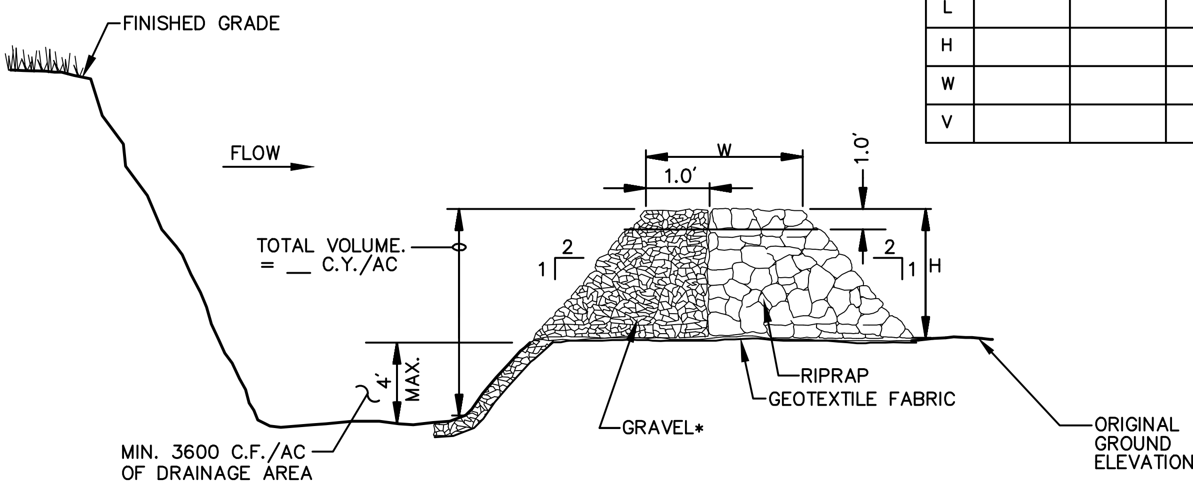
Considerations:

- Locate sediment trap as near the sediment source as topography allows.
- Divert runoff from undisturbed areas away from sediment trap.
- Sediment traps may be installed before land disturbance occurs in the drainage area.

Maintenance:

- The trap should be readily accessible for periodic maintenance and sediment removal.
- Remove sediment when it has accumulated to one-half the design depth.
- Inspect sediment trap after each significant rainfall event.
- Clean or replace spillway gravel facing if clogged.
- Promptly replace any displaced riprap, being careful that no stones in the spillway are above design grade.

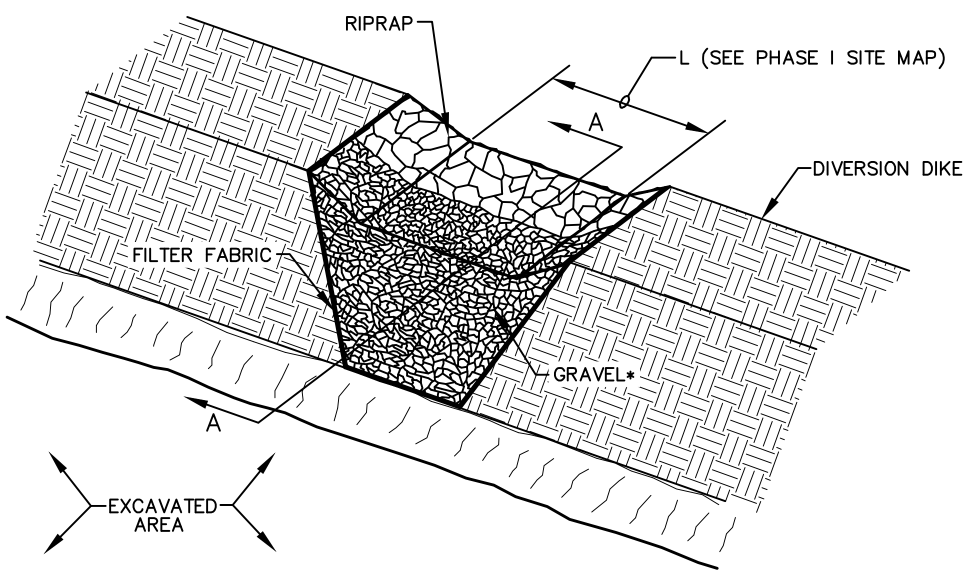
OUTLET DIM (FT).			
	TRAP 1	TRAP 2	TRAP 3
L			
H			
W			
V			



SECTION A–A

* GRAVEL SHALL BE 2"–3" CLEAN STONE

NOTE:
PROVIDE DIMENSIONS AND VOLUME FOR AND LABEL EACH SEDIMENT TRAP LOCATED ON THE PLANS. (SEE SITE MAPS)



OUTLET (PERSPECTIVE)

MAX DRAINAGE AREA:
5 ACRES

L (IN FEET) = 6' OR
1 x DRAINAGE AREA (AC)
WHICHEVER IS LARGER

SOURCE: DOUCET & ASSOCIATES, INC.

SCALE:
NOT TO SCALE

Temporary Sediment Trap

11/1/07
SED–20