Unit Eight

SESC PLAN REVIEW/DOCUMENT EXERCISES

Introduction

This unit is intended to provide the reader with an introductory experience with the process of reviewing and developing Soil Erosion and Sedimentation Control (SESC) plans. It contains several exercises which require the reader to utilize information presented throughout the manual. Specifically, a competent SESC planner must be knowledgeable about the appropriate use of SESC measures. The reader should be familiar with information in Unit 2 and Appendix I before completing these exercises.

Completed examples of each of the exercises appear in the appendices after the chapter. The reader should review the examples and gain understanding about each exercise prior to moving to the next exercise. It should be noted that there are often several "appropriate" ways to solve SESC issues at construction sites, and therefore, the reader should not expect to have identical answers to the examples provided. The objective of the reader should be to understand how the information in other units of this manual relates to the planning process and how to properly utilize that information to assure that SESC issues are addressed and the plan is compliant with Part 91.

Plan Review Exercise

Sites which require an SESC permit, and many projects undertaken by APAs, are required by Rule 1703 to develop an SESC plan which contains, at a minimum, the following information:

- ☐ **Map (plan) with a scaled drawing of not more than 200 feet to the inch**
- ☐ **A site location sketch**
- ☐ **The proximity of the proposed earth change to lakes and streams**
- ☐ **Predominant land features**
- ☐ **Existing and proposed contour intervals or slope description**
- ☐ **A soils survey or written description of the soils of the anticipated exposed land area**
- ☐ **A description and the location of the physical limits of each proposed earth change**
- ☐ **A description and the location of all existing and proposed on-site drainage and dewatering facilities**
- ☐ **The timing and sequence of each proposed earth change**
- ☐ **The location and description for installing and removing all proposed temporary SESC measures**
- ☐ **A description and the location of all proposed permanent SESC measures**
- ☐ **A program proposal for the continued maintenance of all permanent SESC measures, including the person responsible for the maintenance**

Exercise 1: Figure 10-1 provides an example of an SESC plan that does not contain all elements in Rule 1703 and is inadequate in terms of SESC measures. Check the required elements you find on the previous page. Note any other inadequacies on the plan. A completed example of Exercise 1 is located in Appendix 10A.

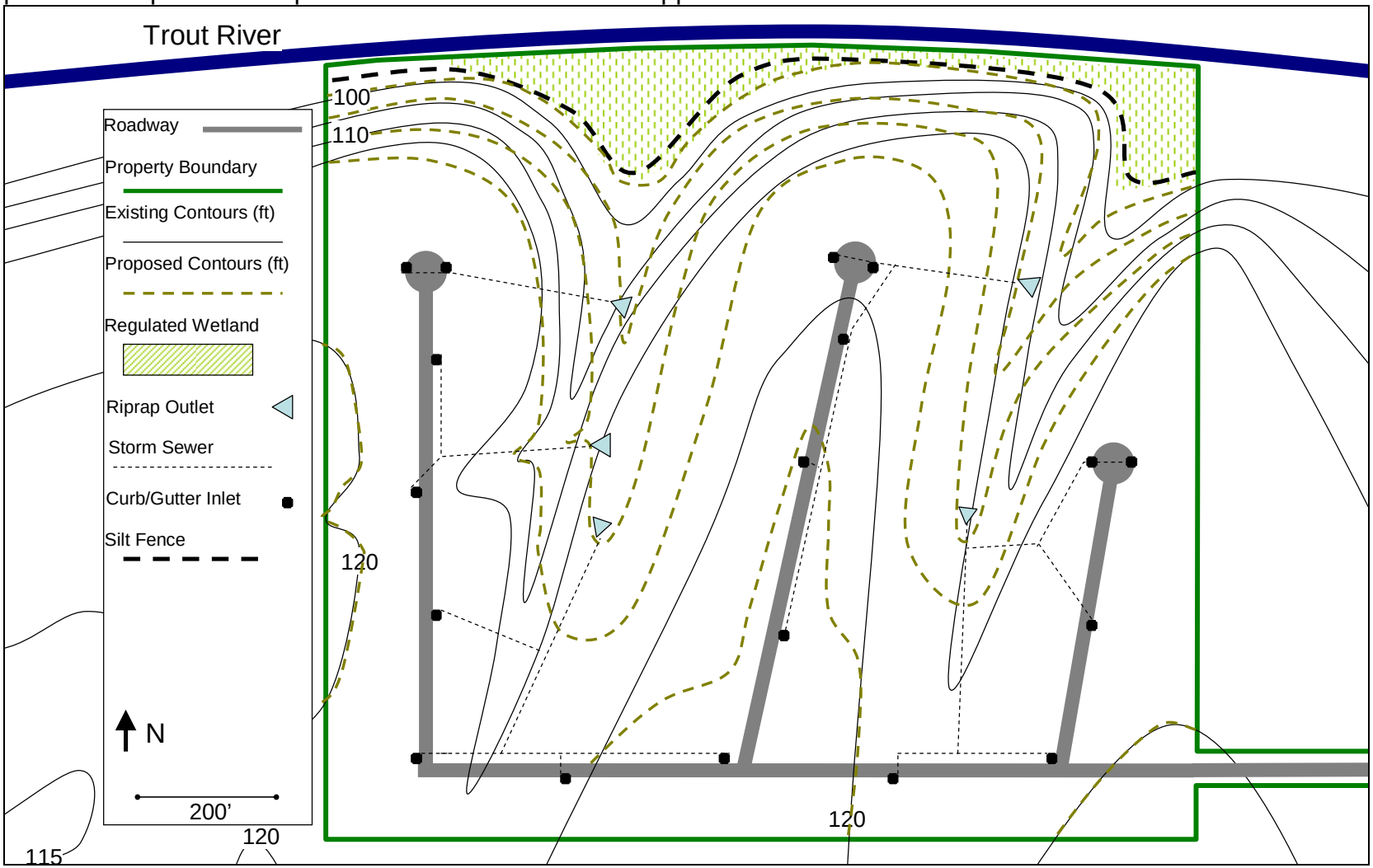


Figure 10-1: Example of Inadequate SESC Plan

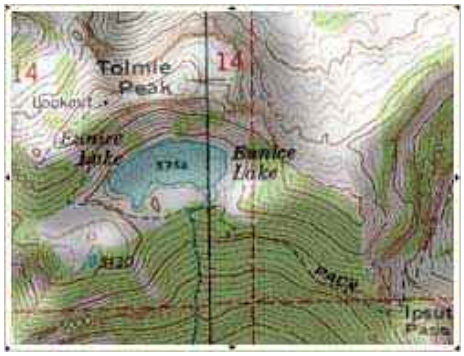
Plan Development Exercises

Construction projects are often very complex. Construction and funding timetables, owner objectives, aesthetic concerns, project infrastructure, materials costs, and other federal, state, and local laws are all major considerations which will affect the outcome. Considerations of some of these factors go beyond the scope of this manual; however, having a clear understanding of them is necessary when developing an effective SESC plan.

Step One - Gather Site Information

The following exercises utilize the planned development from the Plan Review Exercise (Exercise 1). For the purposes of these exercises, we will assume that the layout, grading changes, and infrastructure have been determined by the owner. As an SESC planner, we may request changes to the owner's plans as we move through the planning process.

Units 4 and 7 of this manual describe common sources from which site information can be obtained. Soil surveys, aerial photographs, topographic maps, and/or topographic surveys should be consulted as appropriate. In addition, an inspection of the site is essential during the planning phase, in order to verify the information found in these sources and compile additional information. The primary objective of this information gathering stage is to identify important planning information such as critical areas, sensitive areas, and owner objectives.



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Source: http://websoilsurvey.nrcs.usda.gov/

Exercise 2A: Figure 10-2 (next page) is a site location sketch for the proposed project. It also includes the existing contours and NRCS soil type delineations. Starting at the 110' contour line, draw the concentrated flow areas (prior to grading). Also delineate the runoff contributing area (watershed) for the two primary swales on the site and draw several arrows showing the anticipated sheet flow directions prior to grading.

Exercise 2B: Figure 10-3 (next page) provides the existing and proposed contours at the site. On this map, draw any suspected concentrated flow areas and sheet flow directions after grading is complete. Also, using information from both maps mark any suspected critical areas with a "C" and sensitive areas with an "S." Look both on and around the site. Please see Appendix 10B for completed example maps from Exercise 2

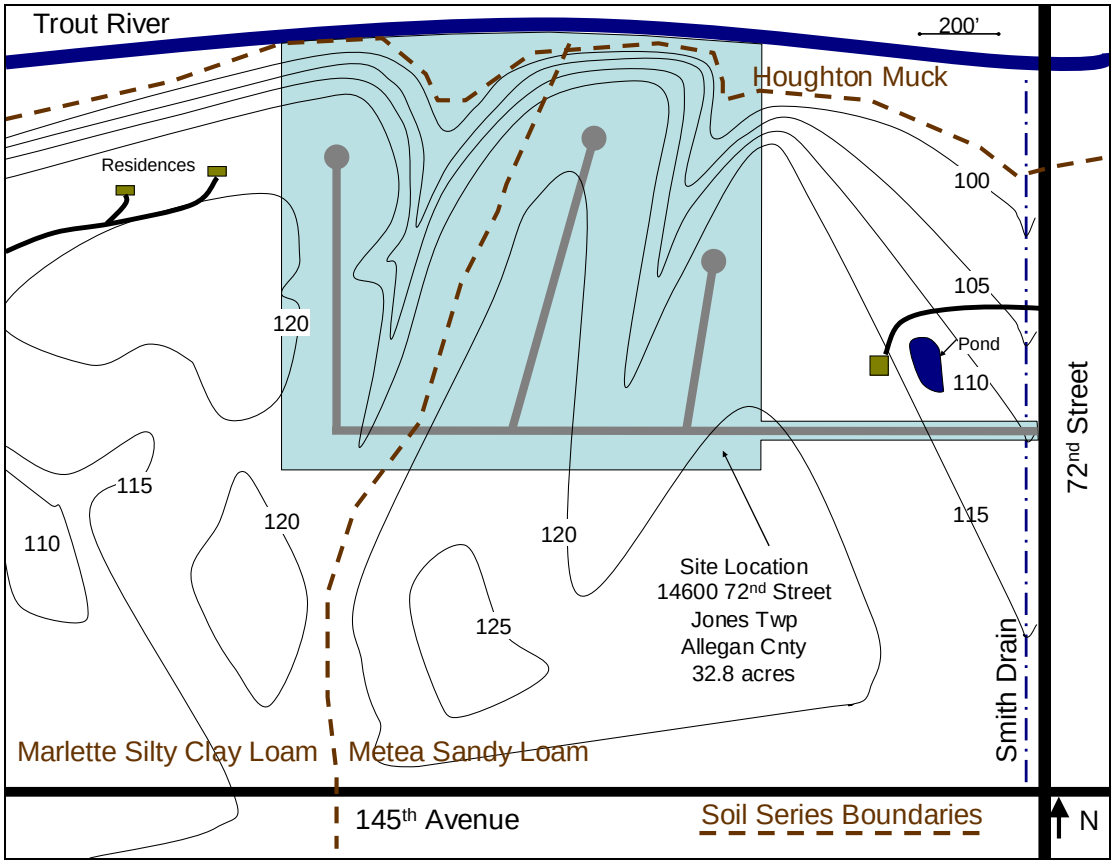


Figure 10-2: Site location sketch for proposed development

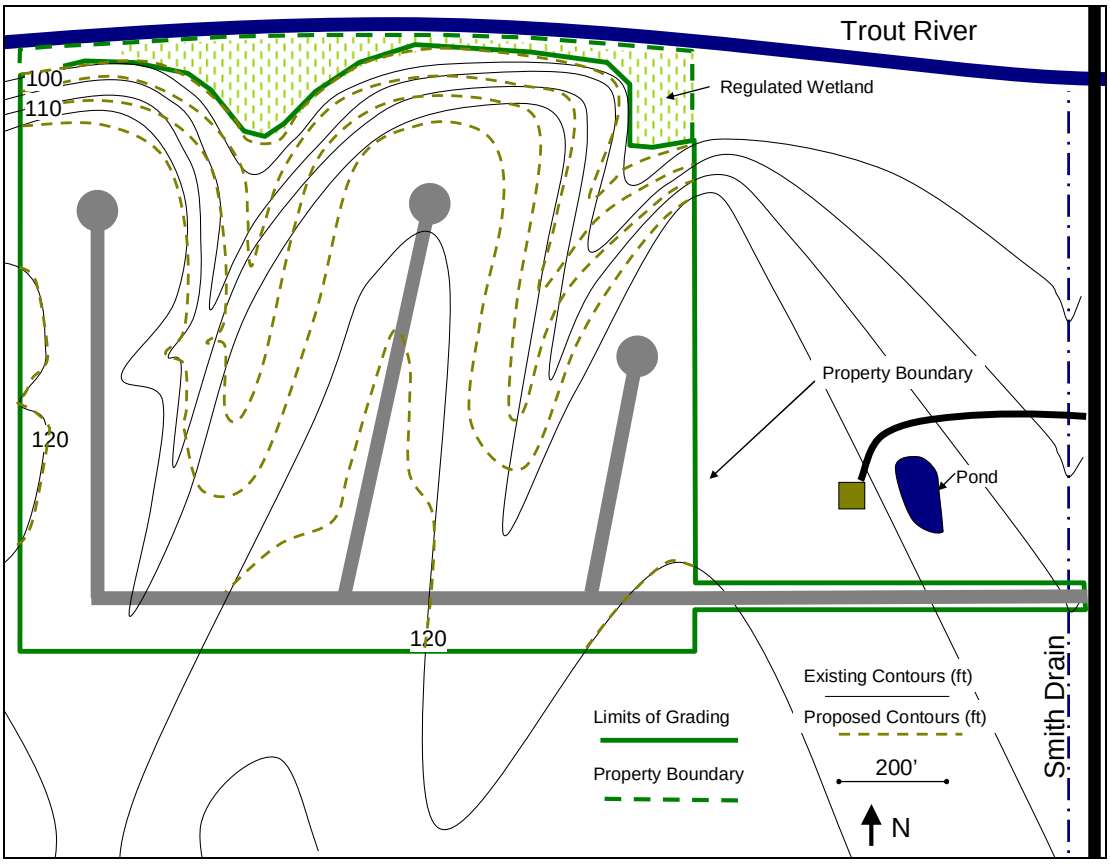


Figure 10-3: Rough grading map for proposed development

During Exercise 2, we have identified several essential pieces of information necessary to develop an effective SESC plan.

Soils Information (from NRCS soil survey):

- Houghton Muck is a poorly drained soil which reinforces the presence of regulated wetlands on the site. However, this soil is not within the area proposed to be graded.
- Marlette Silty Clay Loam is composed of at least 80% silt and clay sized particles making effective sediment control extremely difficult. The Hydrologic Soil Group is B, meaning a moderate to low runoff potential. This soil has relatively high erodibility potential. This soil will be disturbed extensively on the western portion of the site.
- Metea Sandy Loam will generally be composed of greater than 50-80% sand sized particles making sediment control devices generally effective. The Hydrologic Soil Group is B, meaning a moderate to low runoff potential. This soil has relatively low erodibility potential. This soil will be disturbed extensively on the eastern portion of the site.

Sensitive areas:
Regulated wetlands, the Trout River, and the Smith Drain are all down slope of the earth disturbance. In addition, there is a residence with a small pond near the project within the flow path of possible runoff from the site. All of these require special attention during SESC plan development.

Critical areas:
Several areas which have been identified will be difficult to stabilize once disturbed. This includes all concentrated flow areas on the site and steep slopes, with special consideration given to steeper slopes in the western portion of the site where high erodibility soils are located.

Runoff patterns:
After identifying likely sheet flow direction, concentrated flow areas, and watershed boundaries, we can select SESC measures which will effectively protect waters of the state and adjacent properties throughout the entire construction process. We are also aware that the site will receive runoff from outside properties coming from the south and west.

Other important information:
In addition to the information identified above, we also need other important pieces of information before beginning to select and place SESC measures on the site. Some of this information must be obtained from the project owner and/or designer. The questions below have hypothetical answers provided in bold, which will be the assumptions for the SESC planning exercises moving forward:

1. What is the current cover type of the project and in the contributing area? Agricultural? Forested? Grasslands? Parks? **After a site visit we have determined that the project site and surrounding area is currently forested.**

2. Are there any easements, zoning issues, or regulations affecting the site? ***For the purposes of these exercises, we will assume that these issues do not exist, or have been addressed.***
3. We currently do not have enough information about what the project will look like at completion. Will the developer be building the structures (ie. condos) or will the property be subdivided and sold to individual builders and homeowners? ***The developer intends to complete the road and infrastructure only and sell the lots off to individual homeowners or builders.***
4. We know nothing about the timetable for construction. Will the project be completed in phases? When will it start? When will it finish? ***The developer wants to start the project in August 2011 and hopes to have the project completed by July 2012. He does not intend to stage the development. He would like to clear and grub the site in August and September; rough grade October through March (as weather allows), install roads and infrastructure in March/April/May; and final grade and stabilize in June.***
5. Is the proposed storm water system adequately designed to convey water and prevent erosion after construction? ***For the purposes of these exercises, we will assume that the system is adequate.***
6. Cutting back slopes at the site will produce a significant amount of excess soil. How will this be handled? ***For the purposes of these exercises, we will assume that the soil will be trucked to and utilized at a nearby project.***
7. Additional considerations. ***The resident immediately east of the property is angry about the proposed development and has threatened to sue the developer if runoff from the construction site or development causes damage to his yard or trout pond.***

From the information we have gathered about the project we can also create a rough schedule of construction activities as the developer intends them to occur. An example of this appears in Figure 10-4.

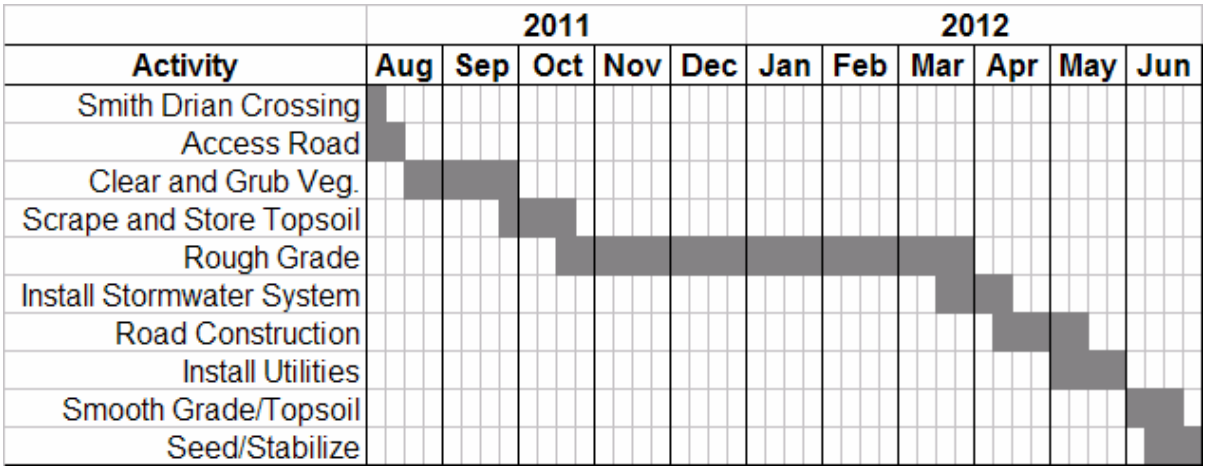


Figure 10-4: Example rough construction schedule for proposed project

Step Two – Identify Issues, Consider Solutions

Exercise 3: Utilizing your knowledge about the site, to create a list of SESC concerns which may occur during the construction activities listed in the schedule above. Identify some possible solutions. Pay close attention to the critical and sensitive areas on or near the site. For assistance, see a completed example list in Appendix 10C

Activity:
Concern:
Solutions:

Activity:
Concern:
Solutions:

Activity:
Concern:
Solutions:

Activity:
Concern:
Solutions:

Activity:
Concern:
Solutions:

Activity:
Concern:
Solutions:

Activity:
Concern:
Solutions:

Activity:
Concern:
Solutions:

Step Three – Select SESC Measures

During step two, we identified potential SESC issues as they applied to our specific site and construction processes. We also identified several possible solutions to these issues. When selecting which SESC measures to utilize to address a particular issue, it is important to remember that an effective SESC plan is a system of individual measures. Generally, there is more than one possible plan or system that can work for an individual site. Also, there are often trade-offs when selecting which measures to utilize. In our example site, mass grading the site starting in October may follow the owners preferred timetable and offer cost savings through an economy of scale. However, mass grading outside the growing season is likely to require much more expensive SESC measures than if the site is scheduled during the growing season and staged. Understanding these trade-offs is an important part of the SESC planning process.

Develop Scheduling and Staging

With regards to our proposed site, the two greatest concerns are the scale and timing of the mass grading at the site. Winter and early spring severe runoff events (concurrent rain and snow melt events with frozen ground) are very common in Michigan. Temporary SESC measures are generally ineffective during these events.

If possible, the plan developer and/or regulator should encourage or require the owner to delay land clearing and mass grading until the next season. At the very least, if the owner is insistent on mass grading the site outside the growing season, the plan should limit the amount of exposed soil that can be allowed at any one time and require extensive mulching. Both of which will add significant cost to the owner. We will proceed with our planned development under the assumption that the owner wishes to avoid some of these additional costs and is receptive to staging the project, but does not want to delay work until March.

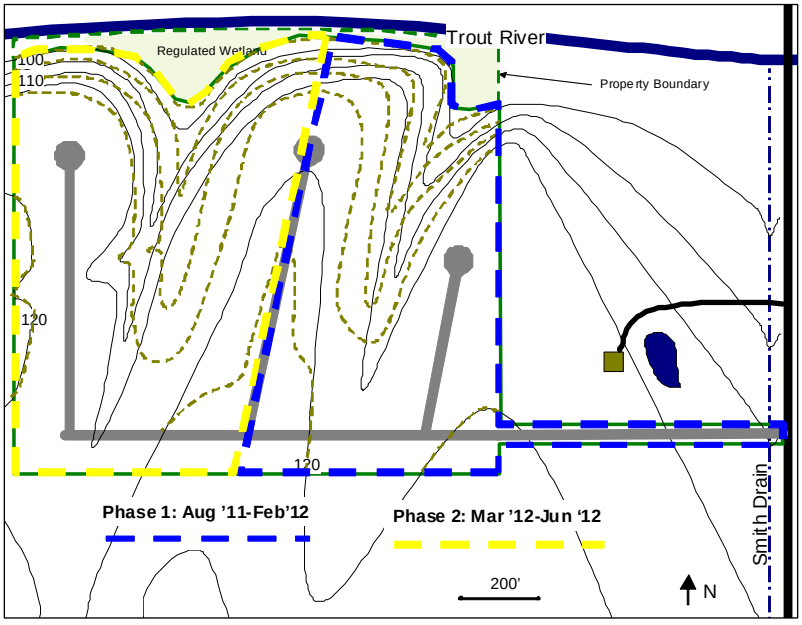


Figure 10-5: Staging map for proposed project

There are many possible options for staging the proposed project. The one presented in Figure 10-5 is one of those options. This proposal avoids disturbing the erodible soils on the western portion of the project and allows for completion and stabilization of eastern critical areas over winter. In addition, it can allow significant progress toward timely project completion.

Select and Place Temporary and Permanent Measures

Exercise 4: Using your knowledge about the site and SESC measures, select and place SESC measures for Phase I of the site on Figure 10-6. Then using the schedule on Figure 10-4 as a base, develop a construction schedule for Phase I including the installation of SESC measures. See Appendix 10D for a completed exercise and construction notes for this portion of the project.

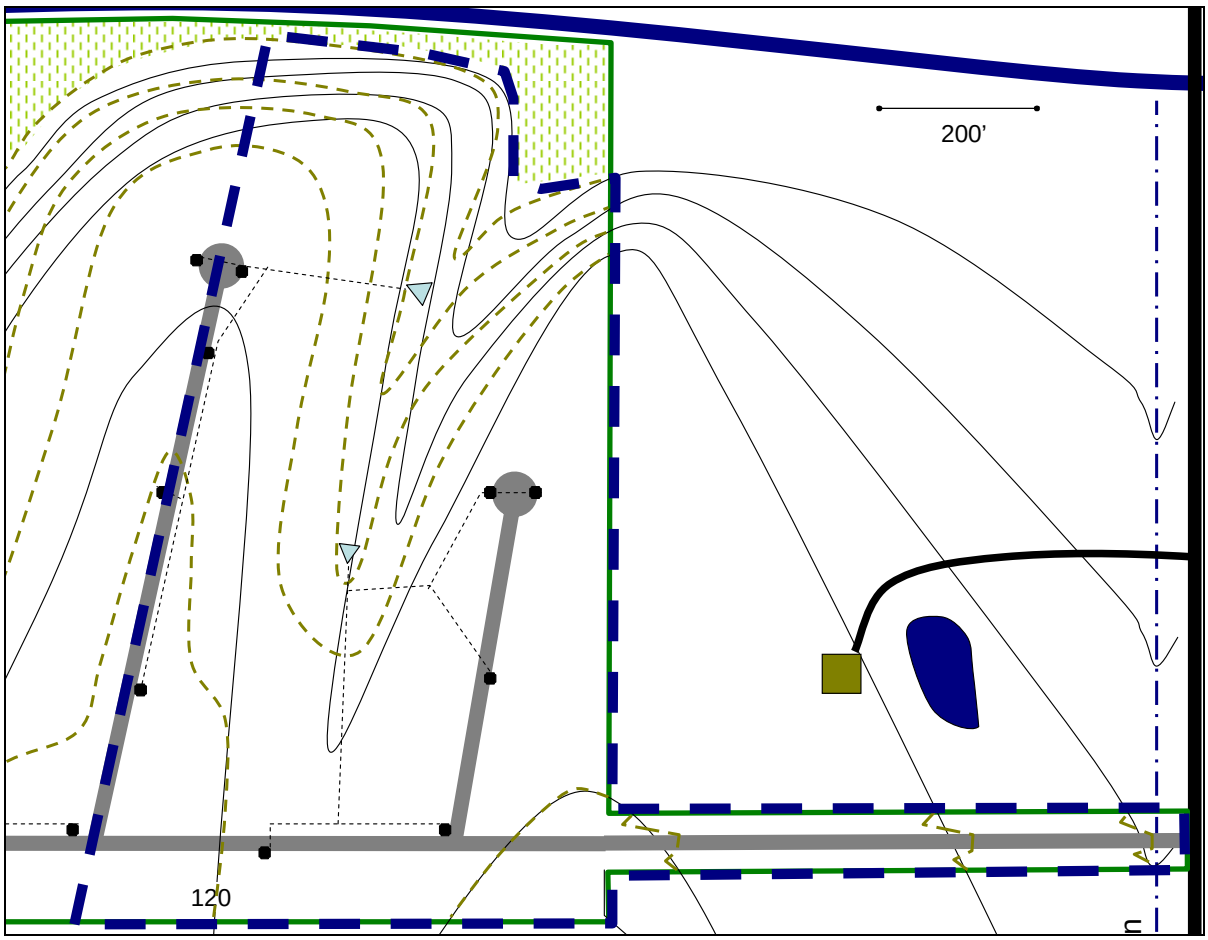


Figure 10-6: Phase 1 SESC Measure Placement Exercise

Schedule:

Exercise 5: Using the same processes from Exercise 4, select and place SESC measures and develop a schedule for Phase 2 of the site on Figure 10-7. See Appendix 10E for a completed exercise and construction notes.

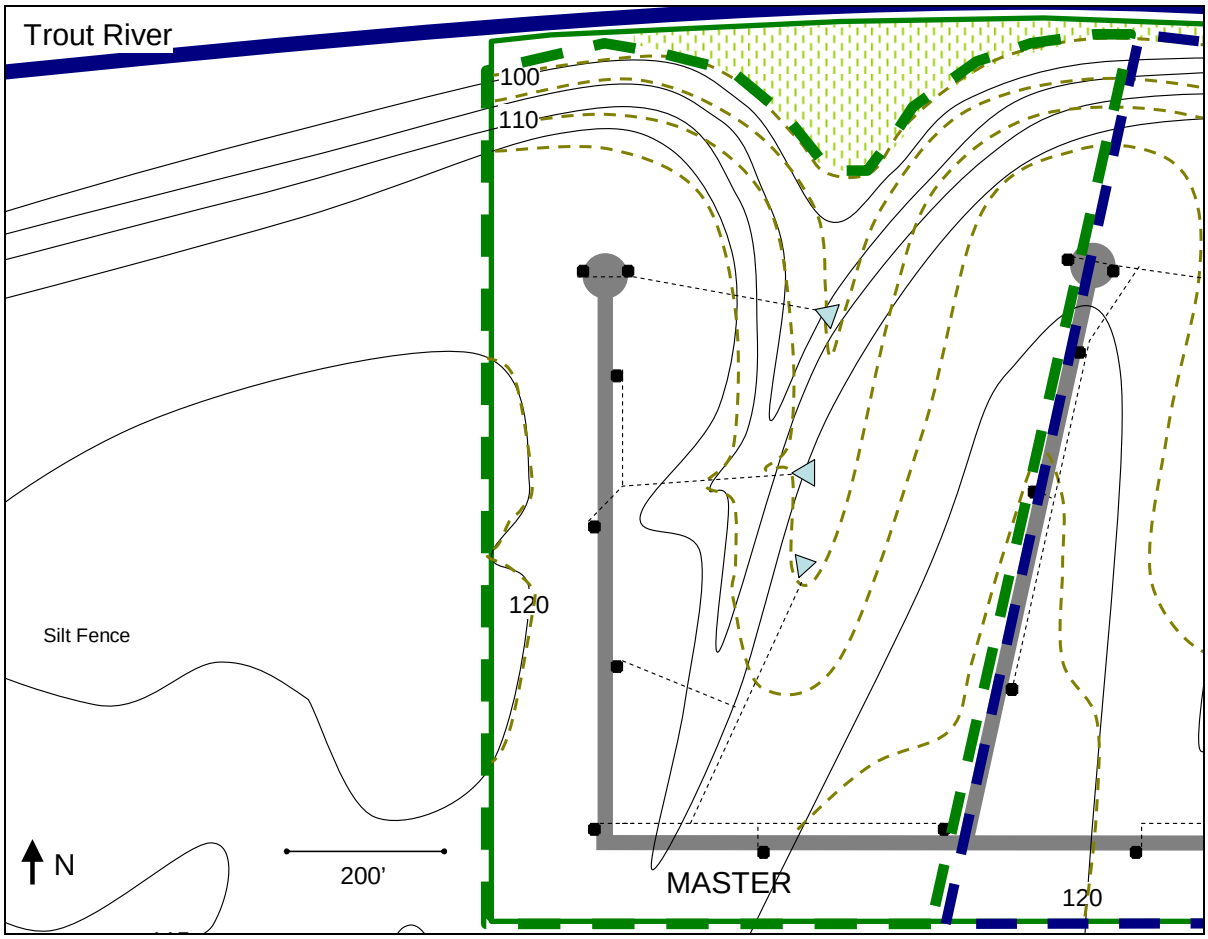


Figure 10-7: Phase 2 SESC Measure Placement Exercise

Schedule:

Step Four – Compile Information in a Completed SESC Plan

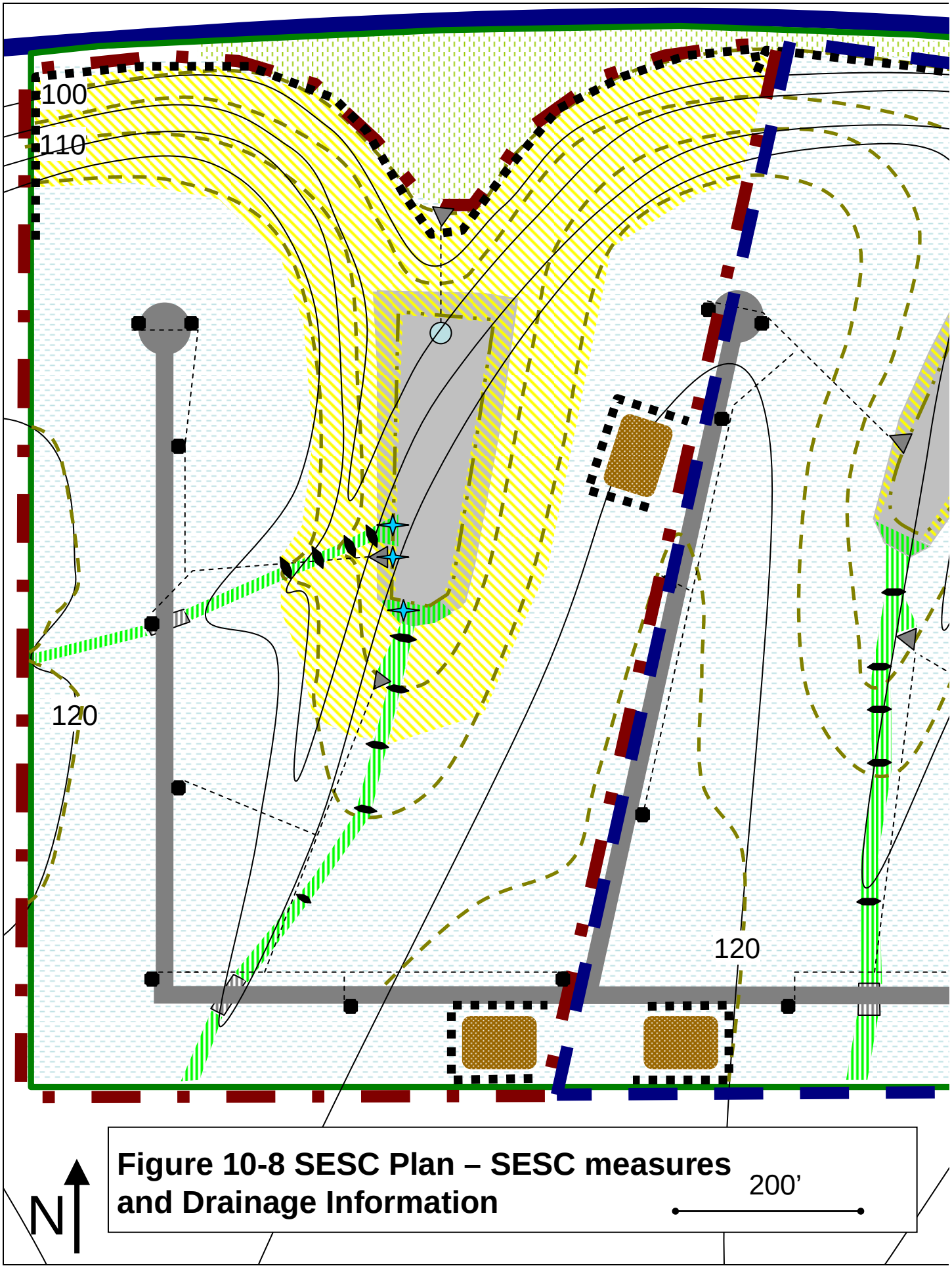
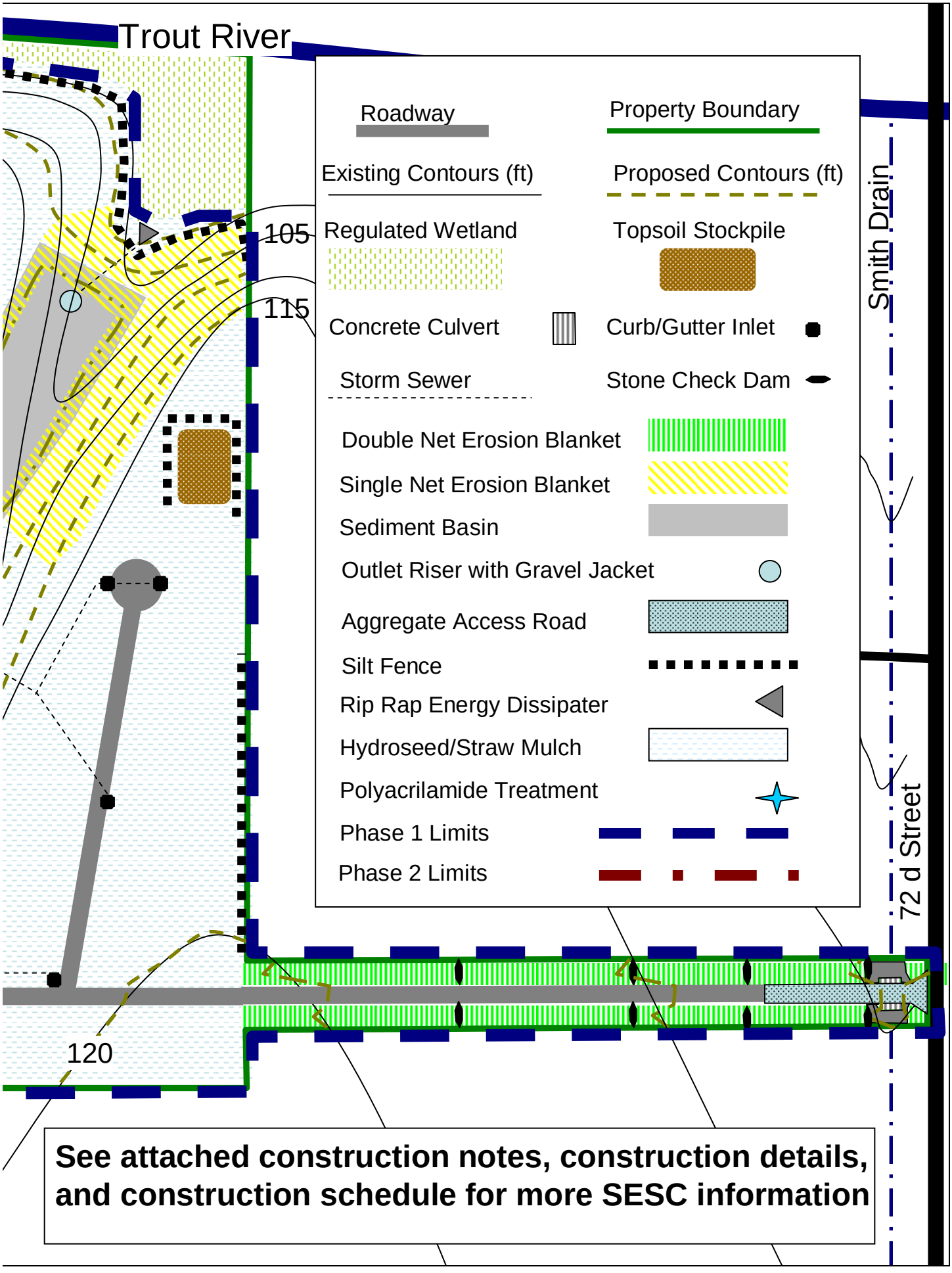


Figure 10-8 SESC Plan – SESC measures and Drainage Information



See attached construction notes, construction details, and construction schedule for more SESC information

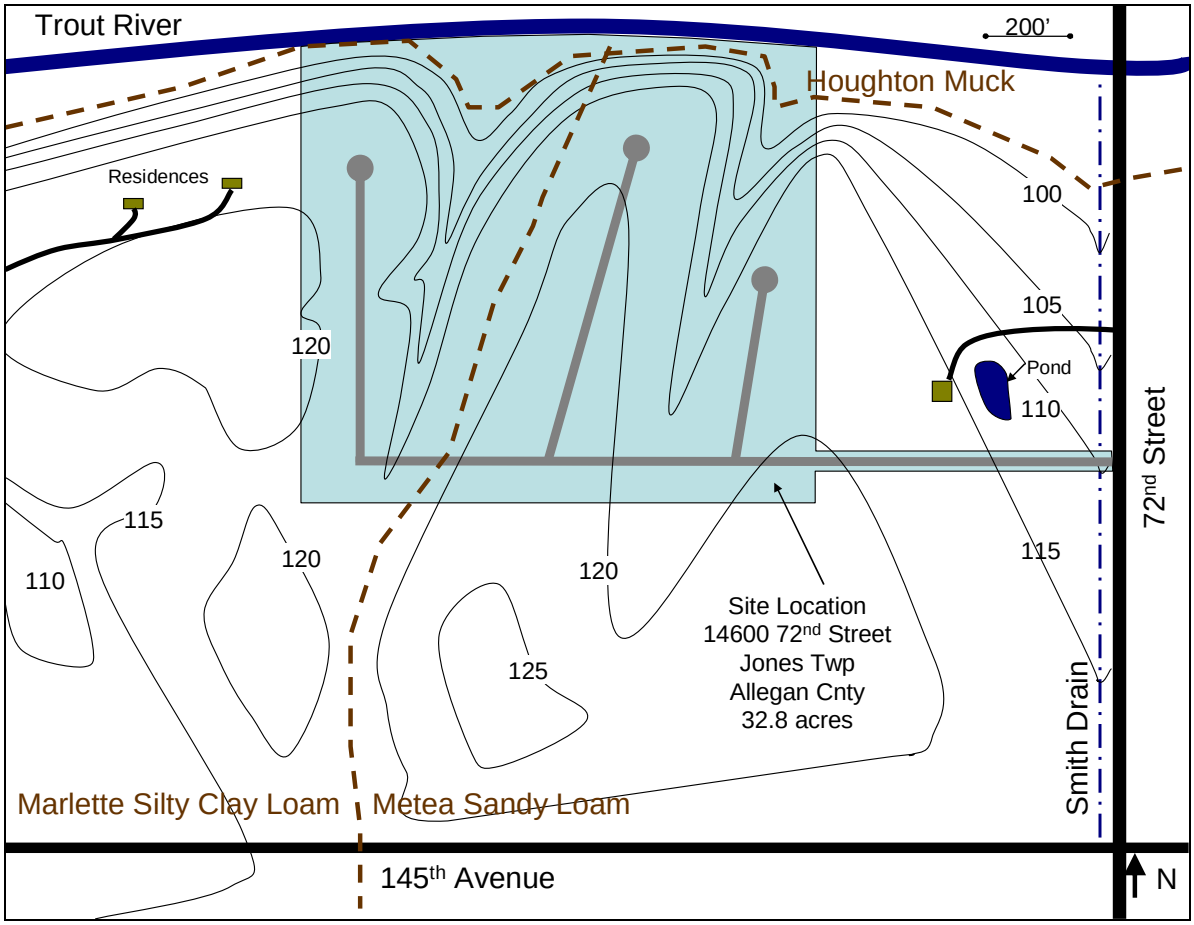


Figure 10-9: Site Location Sketch and Soils Information

Construction Schedule

Phase 1: Begin Construction Approximately August 1, 2011

Week 1: Install Smith Drain Crossing and Rip Rap Stabilization. Install Aggregate Access Road.

Week 2: Clear and grade site entrance road and roadside ditches working away from Smith Drain. Install Seed, Erosion Blankets, and Check Dams at the completion of each days work.

Weeks 3-5: Install Sediment Basin and Silt Fence. Clear and grub topsoil storage areas. Clear, grub, scrape topsoil, and grade only as necessary to facilitate installation and stabilization of these areas. Stabilize with topsoil, seed, erosion blankets and/or mulch as specified after installation.

Weeks 5-7: Clear, grub, scrape topsoil, and rough grade swales, slopes along the wetland boundary, and concentrated flow areas.

Weeks 6-8: Finish grade, replace topsoil, hydroseed, and install erosion blankets, and/or check dams on swales, slopes along wetland boundary, and concentrated flow areas. Complete installation within 5 days after area has reached final grade.

Weeks 8-10: Clear, grub, scrape topsoil, and rough grade in remaining areas in Phase 1 (upland areas near future roads).

Weeks 10-12: Finish grade, replace topsoil, and hydroseed any remaining exposed areas in Phase 1. Complete hydroseeding within 5 days after area has reached final grade. Any areas which cannot be hydroseeded by October 16 must thereafter be hydroseeded and additionally mulched at a rate of 2 tons of straw per acre.

Weeks 13+: Install road base, road surface, curb and gutter, storm water system, and utilities as weather allows. Stabilize disturbed areas with seed and 2 tons of straw per acre within 5 days of completion of each area.

Phase 2: Begin Construction Approximately March 15, 2011
Weeks 1-3: Install Sediment Basin and Silt Fence. Clear and grub topsoil storage areas. Clear, grub, scrape topsoil, and grade only as necessary to facilitate installation and stabilization of these areas. Stabilize with topsoil, seed, erosion blankets, and/or mulch as specified after installation.

Weeks 4-7: Clear, grub, scrape topsoil, and rough grade swales, slopes along the wetland boundary, and concentrated flow areas. Install polyacrylamide treatment systems at swale outlets upon earth change.

Weeks 5-8: Finish grade, replace topsoil, and install erosion blankets, and/or check dams on swales, slopes along wetland boundary, and concentrated flow areas. Complete installation within 5 days after area has reached final grade.

Weeks 9-11: Clear, grub, scrape topsoil, and rough grade in remaining areas in Phase 2 (upland areas near future roads).

Weeks 10-12: Finish grade, replace topsoil, and hydroseed any remaining exposed areas in Phase 1. Complete hydroseeding within 5 days after area has reached final grade.

Weeks 12+: Install road base, road surface, curb and gutter, storm water system, and utilities as weather allows. Install polyacrylamide treatment system, at storm water system outlets into sediment basin immediately upon completion. Stabilize disturbed areas with hydroseed and 2 tons of straw per acre within 5 days of completion of each area.

Construction Notes

General – All structures and SESC measures shall be installed and managed in accordance with manufacturer recommendations and the plan details provided. If neither is provided, the default standards from the 2003 Michigan Department of Transportation Standard Specifications for Construction shall be followed.

Limits of Earth Change – No areas outside those in Phase 1 and Phase 2 shall be cleared, grubbed, or graded at any time during the project. Phase 2 construction shall not begin until Phase 1 is fully completed.

Proposal for ongoing maintenance of permanent SESC measures – Permanent SESC measures will be monitored by the property owner until which time the property or portion of the property is sold. Failures will be corrected immediately.

Aggregate Access Road – Aggregate materials shall be added or replaced as poor space becomes filled with sediment. The aggregate may be removed or paved over when the project is complete.

Concentrated Flow Areas and Ditches – Avoid construction during rain events or when rain/snowmelt is forecasted. Scouring and bank failure shall be corrected immediately.

Sediment Basin – Shall be constructed and stabilized as early during the construction process as possible; and before any other grading on the project. The basin must be restored to full design depth once sediment accumulation exceeds 50% of the design wet depth. The sediment basin may be modified into a permanent storm water basin once all areas within the drainage area are stabilized with permanent vegetation.

Silt Fence – Shall be installed prior to any grading at the project. Silt fence installation shall not cross any concentrated flow areas. Silt fence must be maintained and/or replaced at failure or when sediment reaches 50% of the height of the fence. All silt fence shall be removed once the drainage area is stabilized with permanent vegetation.

Check Dams – Shall be installed at the frequency and location identified in the plans. Accumulated sediment behind check dams shall be removed when it reaches 50% of the height at the center of the check dam. Check dams may be removed once channelized flows are stabilized with permanent vegetation.

Erosion Blanket – Shall be placed on slopes and channels as located on the plans. Topsoil should be graded as smoothly as possible prior to placement. Installation shall be consistent with specifications provided and manufacturer's recommendations. Erosion blanket failure shall be repaired immediately.

Curb and Gutter Inlets – Curb and gutter inlets shall be protected with premanufactured inlet protection devices at all times. Inlet protection devices may be removed once all runoff contributing areas are stabilized with permanent SESC measures. All inlet protection devices shall be removed once the drainage area is permanently stabilized.

Seed/Hydroseed/Straw Mulch – All areas noted to be seeded utilizing a hydroseed mixture of 2000 lbs per acre hardwood fiber mulch with tackifier. Hydroseeding after October 16 and before April 1 shall be additionally stabilized by evenly spreading 2 tons of straw per acre that is properly anchored. All seed mixes shall be 90% or greater pure live seed. Any areas which fail to establish dense permanent stands of vegetation must be reseeded. The following seed mixes shall be used during the noted time periods:
Apr 1 – Sep 30 (200 lbs/acre)

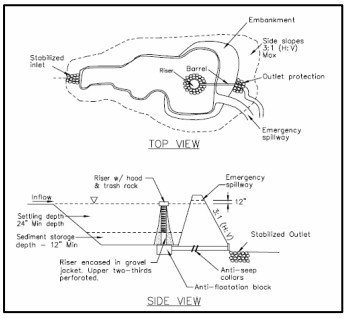
50% Perennial Ryegrass, 30% Creeping Red Fescue, 20% Kentucky Bluegrass
Oct 1 – Freeze/Snow & Thaw – March 31 (220 lbs/acre)
50% Perennial Rye, 30% Creeping Fescue, 15% Kentucky Bluegrass, 5% Winter Wheat (Fall), Spring Wheat (Spring), or Annual Ryegrass
Seeding outside the growing season may require follow up mowing of established annual grasses to limit competition with perennial grasses.

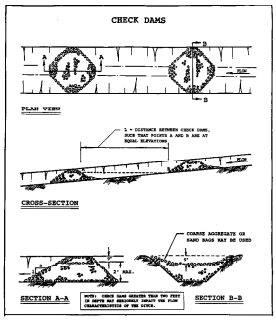
Polyacrylamide (PAM) Treatment – Shall be accomplished with partially hydrated gel blocks of a specific PAM chemical makeup which has been tested and proven effective at flocculating on-site soils. The number and placement of PAM treatment blocks shall be determined by the engineer based on manufacturer recommendations.

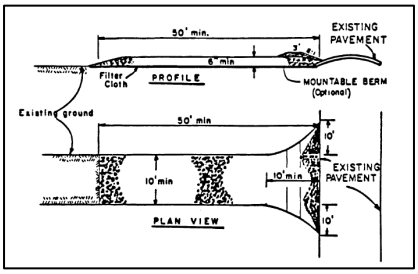
Dust Control – If dry weather conditions persist such that dust is transported outside property boundaries or into the on-site wetland area to the north, any exposed soils on the site shall be wetted via water truck or irrigation equipment. Water application shall be up to, but not beyond the point that applied water begins to runoff. Water applications shall be repeated as necessary.

Construction Details

Construction details and drawings showing proper installation should be included in the SESC plan for each of the SESC measures utilized at the site. These should include material specifications and plan, profile, and cross-section drawings as applicable. See Appendix I for examples of construction details. The actual construction details provided must identify specific materials and measurables as necessary to properly construct SESC measures.







Summary

The preceding information and exercises were intended to give the reader an introductory experience with reviewing and developing SESC plans. Although there are often many ways to solve SESC issues at construction sites, it is important to recognize the capabilities and limitations of each type of SESC measure. In addition, good SESC planning requires significant knowledge about the site, the construction process, seasonal limitations, and the objectives of the owner(s).

The plan developed in this unit meets all the minimum requirements of Rule 1703. In addition, it properly utilizes specific SESC measures as part of a system. If the plan is properly implemented, inspected, and modified as necessary in the future, the example project is likely to maintain compliance with the requirements of Part 91.

Appendix 10A
Completed Example of Exercise 1

1703 Required Plan Components:

☒ **Map (plan) with a scaled drawing of not more than 200 feet to the inch**
It appears that the plan does indeed meet this criterion. However, it appears that the site continues to the east where the apparent access road enters the site. If the earth change will continue into this area, the plan submitted would not meet this criterion. If the earth change is to extend into the access road, it would affect whether or not most of the other following criteria are met.

☐ **A site location sketch**
No specific site location can be ascertained from the plan provided.

☐ **The proximity of the proposed earth change to lakes and streams**
This criterion is not met because there is no clear delineation of where the earth changes will be occurring at the site.

☒ **Predominant land features**
While this information should be confirmed with an on-site inspection, the hills slopes, swales, river*, and wetlands at the site are identified.*

☒ **Existing and proposed contour intervals or slope description**

☐ **A soils survey or written description of the soils of the anticipated exposed land area**
No soils information is provided.

☐ **A description and the location of the physical limits of each proposed earth change**
While most of the site boundaries appear to be provided, the plan does not specifically identify the limits of the earth change. Therefore, the location and effectiveness of measures cannot be identified.

☒ **A description and the location of all existing and proposed on-site drainage and dewatering facilities**
The plan does include storm water drainage infrastructure locations and topographic information necessary to identify surface drainage.

☐ **The timing and sequence of each proposed earth change**
No timing and sequencing information provided. With the scale and risk associated with this project, when and how the project is undertaken could significantly change the SESC measures necessary.

☐ **The location and description for installing and removing all proposed temporary SESC measures**
The location of on-site silt fence is provided, but description information is missing. Also, additional temporary controls may be required.

☐ **A description and the location of all proposed permanent SESC measures**
The road bases and rip rap outlets identified are permanent erosion control measures. However, no information is provided as to what will be used (i.e. vegetation) to stabilize the other areas of the project.

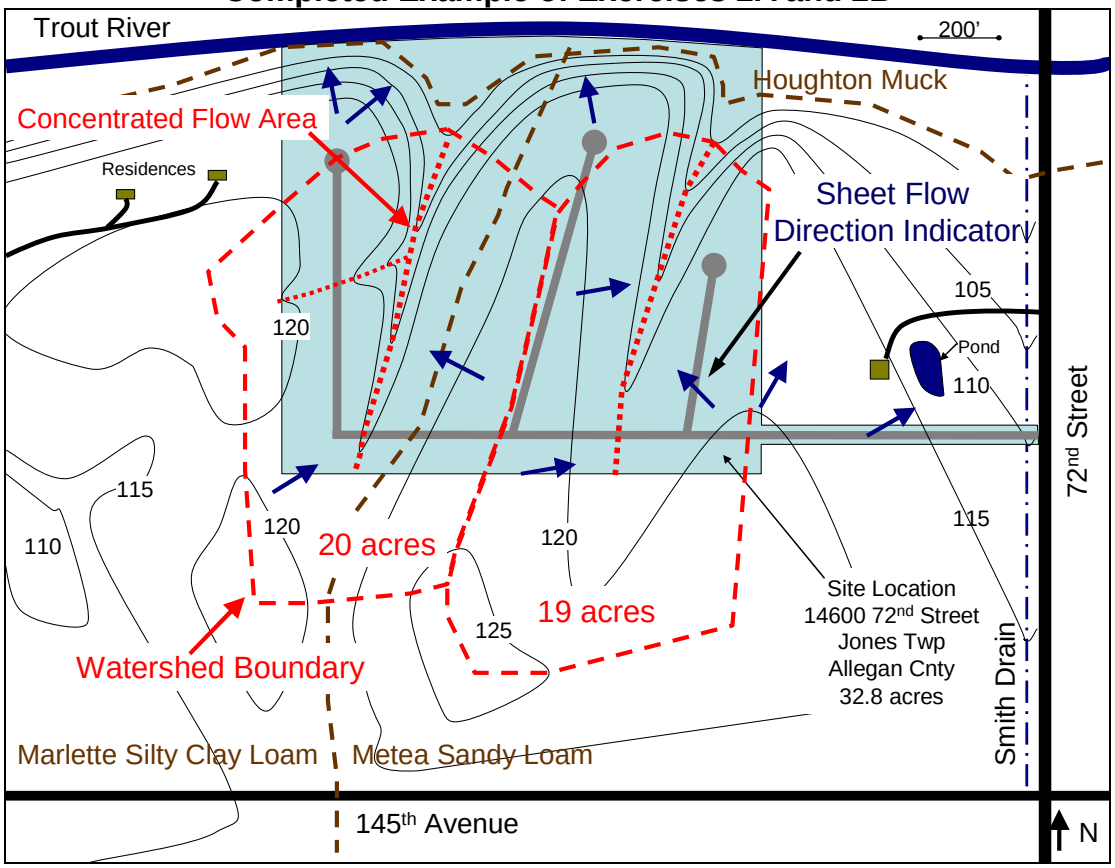
☐ **A program proposal for the continued maintenance of all permanent SESC measures, including the person responsible for the maintenance**
While meeting this component generally does not require extensive details, no information is provided.

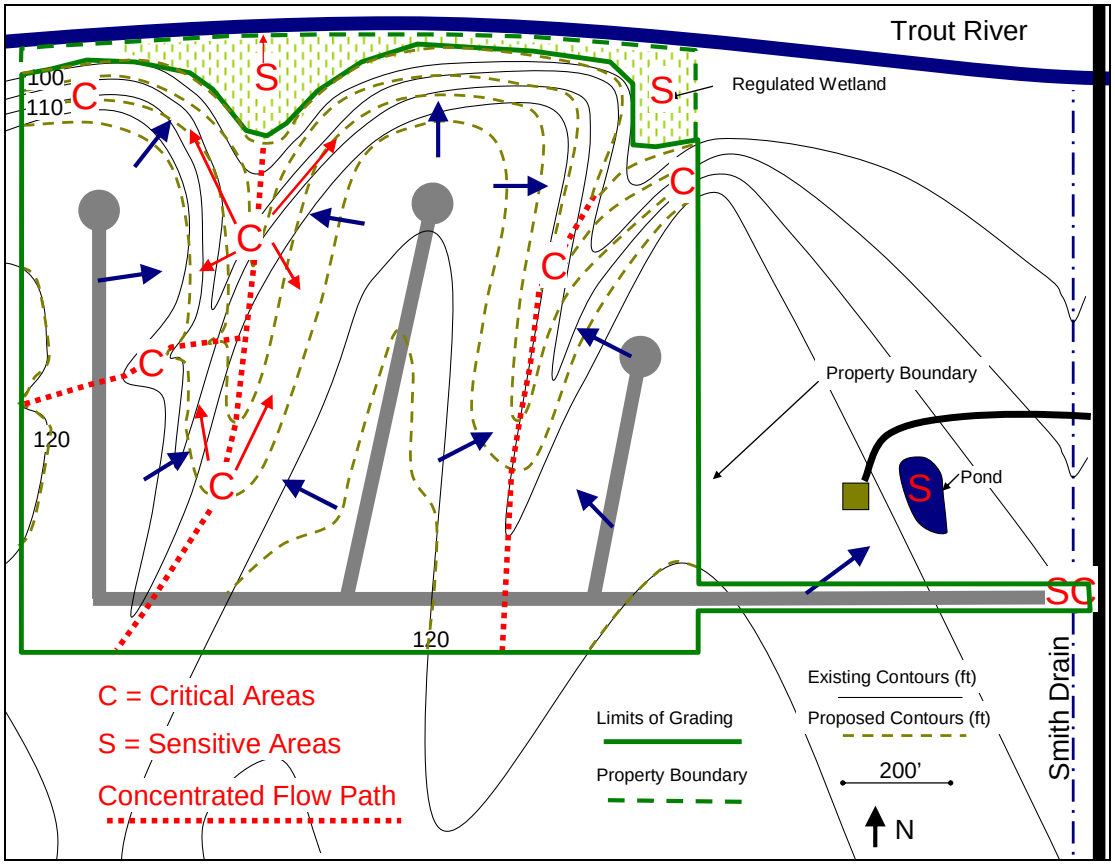
General Comments:

1. As mentioned above, it appears that the access road portion of this project is not covered in this plan.
2. Given the slopes, concentrated flow areas, and extensive grading at this project, silt fence is likely not adequate as the only temporary SESC measure.
3. The silt fence location appears to cross two major concentrated flow areas. Silt fence is not an appropriate measure for concentrated flows.
4. Portions of the silt fence appear to be installed in regulated wetland areas. Sediment retained behind the silt fence would therefore be filling in a regulated wetland and violating Part 91.
5. The plan appears to have significantly more cut areas than fill areas. It can be expected that excess soil will have to be removed from the site, requiring significant traffic off the site. This increases the likelihood of off-site tracking with no noted control measures in place.

The example SESC plan provided above is significantly deficient in terms of required components and technical adequacy. A Part 91 agency should not approve this plan, but rather return it to the designer for significant modification.

Appendix 10B
Completed Example of Exercises 2A and 2B





Appendix 8B-1

Appendix 10C
Completed Example from Exercise 3

Activity: All Stages
Concern: Vehicle track-out onto 72nd Street
Solutions: Aggregate Access Road, Limit vehicle traffic

Activity: Clear and Grub through Vegetative Stabilization
Concern: Sediment control of fine particles on western portion of site
Solutions: Prioritize erosion control and stabilization, Polymer sediment controls

Activity: Clear and Grub through Vegetative Stabilization
Concern: Erosion and or sediment control in the two major swales on-site
Solutions: Prioritize stabilization, sediment basins, check dams, erosion blankets

Activity: Smith Drain Crossing
Concern: Work in and adjacent to a stream
measures, prioritize stabilization of critical areas

Activity: Scrape and Store Topsoil
Concern: Topsoil stockpile erosion and loss
Solutions: Setback from sensitive areas and concentrated flow areas, avoid areas receiving runoff, stabilize with vegetation, contain with perimeter controls

Activity: Scrape and Store Topsoil through Rough Grade
Concern: Exposed soils in winter/spring
Solutions: Scheduling/staging, stabilize with vegetation in growing season, cover crop, mulching, erosion blankets

Activity: Rough Grade
Concern: Redirecting concentrated flow areas
Solutions: Stabilize quickly, utilize turbidity curtains or coffer dams during construction, detailed design criteria

Activity: Access Road Construction
Concern: Runoff toward residence and pond
Solutions: Diversion/Ditch, vegetative buffer, perimeter controls (silt fence)

Activity: Clear and Grub Veg.
Concern: Large areas of exposed soil/Destabilizing critical areas
Solutions: Scheduling/staging, utilize wood chips and woody debris from clearing, limit scope of clearing, install temporary SESC measures.

Activity: Scrape and Store Topsoil
Concern: Large areas of exposed soil/Destabilizing critical areas
Solutions: Scheduling/staging, limit scope of clearing, temporary SESC

Solutions: Scheduling, prioritize completion and stabilization, check dams, erosion control blankets

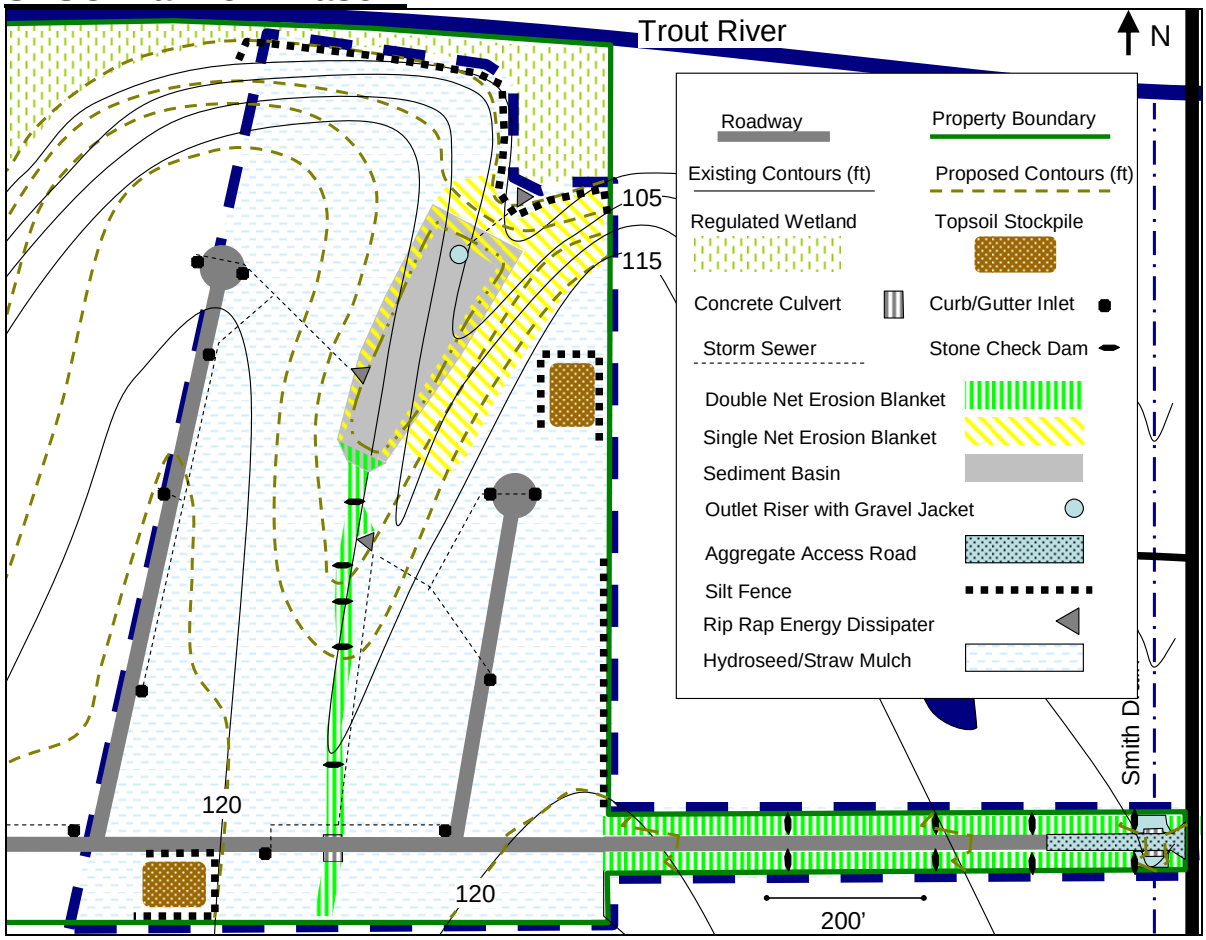
Activity: Install Storm Water System
Concern: Control sediment inputs into storm water system and discharge into sensitive areas
Solutions: Prioritize stabilization, inlet protection, direct to treatment

Activity: Finish Grade/Topsoil
Concern: Slippage or washout of topsoil
Solutions: Subsoil/topsoil interface roughness, erosion control measures in critical areas

Activity: Seed/Stabilize
Concern: Establishment**/**Failure
Solutions: Seed selection, mulch, soil amendment, irrigation due to season,

Appendix 10D
Completed Example from Exercise 4

SESC Plan for Phase 1



Phase 1 Example Construction Schedule

Begin Construction Approximately August 1, 2011

Week 1: Install Smith Drain Crossing Culvert, Rip Rap Stabilization, and Aggregate Access Road

Week 2: Clear and grade site entrance road and roadside ditches working away from Smith Drain. Install Seed, Erosion Blankets, and Check Dams at the completion of each days work.

Weeks 3-5: Install Sediment Basin and Silt Fence. Clear and grub topsoil storage areas. Clear, grub, scrape topsoil, and grade only as necessary facilitate installation and stabilization of these areas. Stabilize with seed and mulch as specified after installation.

Weeks 5-7: Clear, grub, scrape topsoil, and rough grade swales, slopes along the wetland boundary, and concentrated flow areas.

Weeks 6-8: Finish grade, replace topsoil, hydroseed, and install erosion blankets, and/or check dams on swales, slopes along wetland boundary, and concentrated flow areas. Complete installation within 5 days after area has reached final grade.

Weeks 8-10: Clear, grub, scrape topsoil, and rough grade in remaining areas in Phase 1 (upland areas near future roads).

Weeks 10-12: Finish grade, replace topsoil, and hydroseed any remaining exposed areas in Phase 1. Complete hydroseeding within 5 days after area has reached final grade. Any areas which cannot be hydroseeded by October 16 must thereafter be hydroseeded and additionally mulched at a rate of 2 tons of straw per acre.

Weeks 13+: Install road base, road surface, curb and gutter, storm water system, and utilities as weather allows. Stabilize disturbed areas with hydroseed and 2 tons of straw per acre within 5 days of completion of each area.

Construction Notes (*Decision making commentary in italics*):

General – All structures and SESC measures shall be installed and managed in accordance with manufacturer recommendations and the plan details provided. If neither is provided, the default standards from the 2003 Michigan Department of Transportation Standard Specifications for Construction shall be followed.

Limits of Earth Change – No areas outside those in Phase 1 and Phase 2 shall be cleared, grubbed, or graded at any time during the project. Phase 2 construction shall not begin until Phase 1 is fully completed.

Proposal for ongoing maintenance of permanent SESC measures – Permanent SESC measures will be monitored by the property owner until which time the property or portion of the property is sold. Failures will be corrected immediately.
Fulfills a Rule 1703 Plan Requirement

Concrete Culverts – Shall be installed in accordance with details and specifications provided
There are many types of culverts and channel crossing options available. As a general rule, culverts that span the entire high flow channel and allow for natural substrate are preferable environmentally. The height of installation of closed culverts is critical. They should never be placed to high (causing a spill pool and blocking fish passage) or too low (restricting high flow events).

Aggregate Access Road – Aggregate materials shall be added or replaced as poor space becomes filled with sediment. The aggregate may be removed or paved over when the project is complete.
Given the amount of expected construction traffic an aggregate access road is absolutely necessary for this project. One special concern is the Smith Drain near the site egress. Therefore, the length of the aggregate access road was increased

beyond the minimum 50' length to promote sediment removal at a greater distance from the drain.

Concentrated Flow Areas and Ditches – Avoid construction during rain events or when rain/snowmelt is forecasted. Scouring and bank failure shall be corrected immediately.
The site information included in this chapter addressed concerns related to the neighbor's house and the pond to the east of the project. Runoff from the entrance road would have travelled toward this neighbor's property. Therefore, diversions with check dams for sediment removal were provided in order to divert runoff into the Smith Drain. Check dams provide only limited sediment removal; therefore, stabilizing this area rapidly was given a high priority in scheduling.

Sediment Basin – Shall be constructed and stabilized as early during the construction process as possible; and before any other grading on the project. The basin must be restored to full design depth once sediment accumulation exceeds 50% of the design wet depth. The sediment basin may be modified into a permanent storm water basin once all areas within the drainage area are stabilized with permanent vegetation.
The on-site swales provide excellent locations for sediment basins which can treat most of the runoff from the site. Adding a sediment basin required changes to the proposed grade and relocation of the storm sewer outlets to increase flow path prior to discharge. The sandy loam soils in this area should allow for effective sediment removal by the basin. Given the design criteria for sediment basins provided in Chapter 9, the recommended basin size for the drainage area is 92'X370'x2'. This was amended slightly to fit site constraints. Please note that this drainage area includes several acres to the south of the site. The basin size could be reduced if diversion of the off-site runoff is possible.

Silt Fence – Shall be installed prior to any grading at the project. Silt fence installation shall not cross any concentrated flow areas. Silt fence must be maintained and/or replaced at failure or when sediment reaches 50% of the height of the fence. All silt fence shall be removed once the drainage area is stabilized with permanent vegetation.
The silt fence at the site is installed parallel to contour lines and curved upslope at the terminal ends to prevent runoff circumventing the fence. The drainage area contributing runoff to the silt fence does not exceed ½ acre per 100' of fence. Also, note that the silt fence is installed upslope from the sediment basin. The silt fence likely would fail in this concentrated flow area. The basin provides treatment of this water. The silt fence installed along the eastern property line of the project was included to provide treatment for runoff from the small area of disturbance which flows northeasterly along that area.

Topsoil Stockpiles
Stockpiles were placed in upland areas, with minimal runoff contributing areas upslope. Maximum feasible distance from sensitive areas should be maintained. Given the short duration of stockpiling, one pile was allowed in the northeast quadrant somewhat close to the slope and wetland, hopefully minimizing hauling distance and facilitating stabilization of nearby critical areas.

Check Dams – Shall be installed at the frequency and location identified in the plans. Accumulated sediment behind check dams shall be removed when it reaches 50% of the height at the center of the check dam. Check dams <u>may</u> be removed once channelized flows are stabilized with permanent vegetation.
The spacing provided on the plan assumes a 2.5' height in the center of the dam. Therefore, there are 2 check dams for every 5' contour line.

Erosion Blanket – Shall be placed on slopes and channels as located on the plans. Topsoil should graded as smoothly as possible prior to placement. Installation shall be consistent with specifications provided and manufacturers recommendations. Erosion blanket failure shall be repaired immediately.
Erosion blankets specifications are highly dependent on slope length, slope steepness, and velocity and depth of runoff water. Specific blankets and installation guidelines should be specified.

Curb and Gutter Inlets – Curb and gutter inlets shall be protected with <u>premanufactured inlet protection devices</u> at all times. Inlet protection devices may be removed once all runoff contributing areas are stabilized with permanent SESC measures. All inlet protection devices shall be removed once the drainage area is permanently stabilized.
All curb and gutter inlets flow into the sediment basin. Therefore, installation of inlet protection will probably provide little additional protection of sensitive areas. However, it will help to ensure proper function of the storm water system.

Seed/Hydroseed/Straw Mulch – All areas noted to be seeded utilizing a hydroseed mixture of 2000 lbs per acre hardwood fiber mulch with tackifier. Hydroseeding after October 16 and before April 1 shall be additionally stabilized by evenly spreading 2 tons of straw per acre that is properly anchored. All seed mixes shall be 90% or greater pure live seed. Any areas which fail to establish dense permanent stands of vegetation must be reseeded. The following seed mixes shall be used during the noted time periods:
<u>Apr 1 – Sep 30 (200 lbs/acre)</u>
50% Perennial Ryegrass, 30% Creeping Red Fescue, 20% Kentucky Bluegrass
<u>Oct 1 – Freeze/Snow & Thaw – March 31 (220 lbs/acre)</u>
50% Perennial Rye, 30% Creeping Fescue, 15% Kentucky Bluegrass, 5% Winter Wheat (Fall), Spring Wheat (Spring), or Annual Ryegrass
Seeding outside the growing season may require follow up mowing of established annual grasses to limit competition with perennial grasses.
An alternative seed mix and additional mulching is required for seeding that occurs outside the recommended seeding dates in spring and fall. In this case, an annual companion crop is added. A companion crop provides rapid germination and establishment, preventing erosion and protecting the seed bed. Also, the species selected will continue to grow well outside the normal growing season for many other types of grasses.

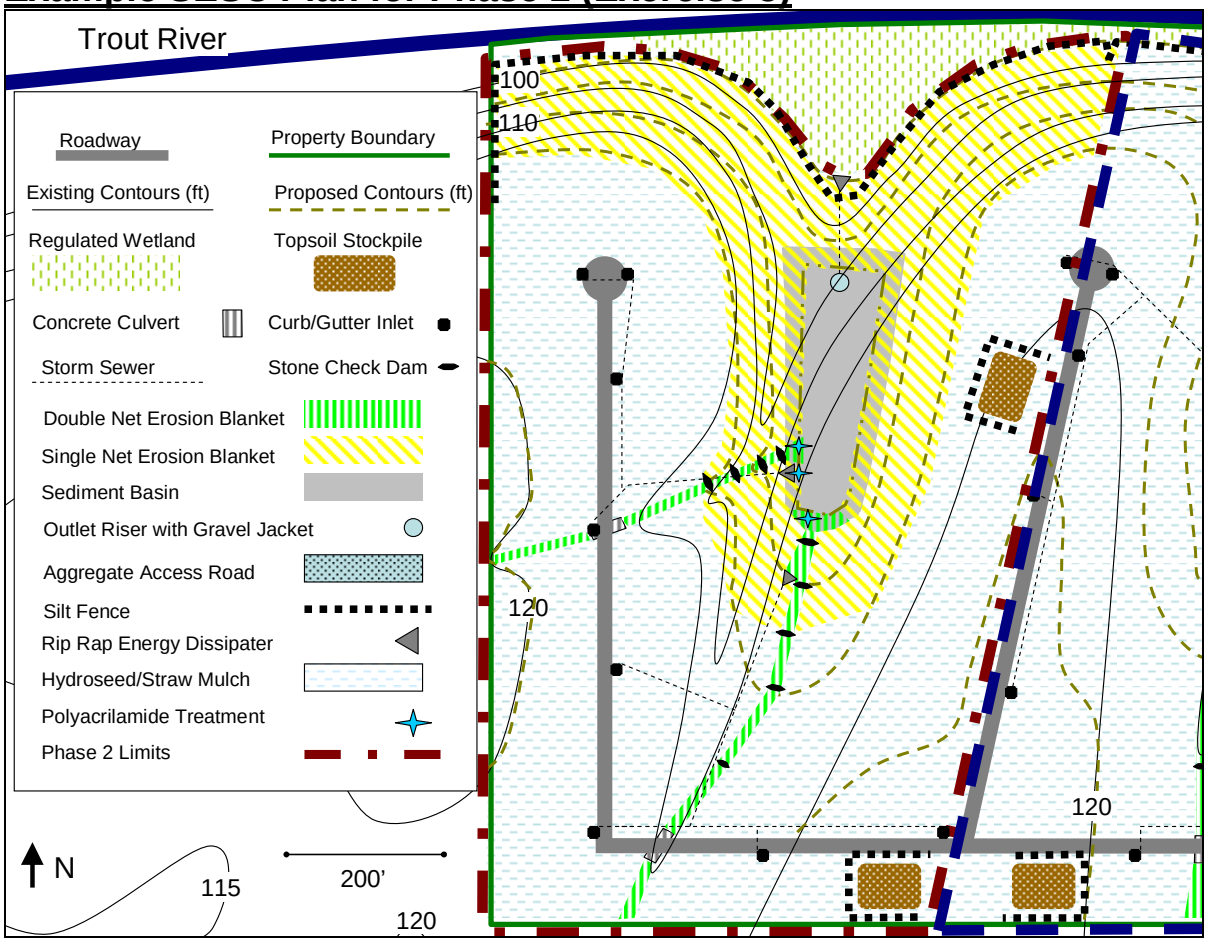
Dust Control – If dry weather conditions persist such that dust is transported outside property boundaries or into the on-site wetland area to the north, any exposed soils on the site shall be wetted via water truck or irrigation equipment. Water application shall be up to, but not beyond the point that applied water begins to runoff. Water applications shall be repeated as necessary.

Construction Details

For this example project, SESC construction/installation details and material specifications are necessary for each of the following: Sediment basin, riser outlet, check dams, energy dissipaters, silt fence, culvert installations, concentrated flow channels, aggregate access road, and catch basin installation. Details and specifications are not provided in this example. Please see the specification sheets in Chapter 9 for more information and example details

Appendix 10E
Completed Example from Exercise 5

Example SESC Plan for Phase 2 (Exercise 5)



Phase 2 Example Construction Schedule

Start Phase 2 approx. March 15, 2012 as weather allows

Weeks 1-3: Install Sediment Basin and Silt Fence. Clear and grub topsoil storage areas. Clear, grub, scrape topsoil, and grade only as necessary facilitate installation and stabilization of these areas. Stabilize with seed and mulch as specified after installation.

Weeks 4-7: Clear, grub, scrape topsoil, and rough grade swales, slopes along the wetland boundary, and concentrated flow areas. Install polyacrylamide treatment systems at swale outlets upon earth change.

Weeks 5-8: Finish grade, replace topsoil, and install erosion blankets, and/or check dams on swales, slopes along wetland boundary, and concentrated flow areas. Complete installation within 5 days after area has reached final grade.

Weeks 9-11: Clear, grub, scrape topsoil, and rough grade in remaining areas in Phase 2 (upland areas near future roads).

Weeks 10-12: Finish grade, replace topsoil, and hydroseed any remaining exposed areas in Phase 1. Complete hydroseeding within 5 days after area has reached final grade.

Weeks 12+: Install road base, road surface, curb and gutter, storm water system, and utilities as weather allows. Install polyacrylamide treatment system, at storm water system outlets, into sediment basin immediately upon completion. Stabilize disturbed areas with seed and 2 tons of straw per acre within 5 days of completion of each area.

Construction Notes (*Decision making commentary in italics)*

Include all notes from Phase 1

Erosion Blankets
Phase 2 of the site has significantly more erodible soils than those found in Phase 1. Therefore, more critical areas exist. In addition, the fine textured soils will reduce the effectiveness of sediment control measures, making erosion control more important.

Polyacrylamide (PAM) Treatment – Shall be accomplished with partially hydrated gel "logs" of a specific PAM chemical makeup which has been tested and proven effective at flocculating on-site soils. The number and placement of PAM treatment logs shall be determined by the engineer based on manufacturer recommendations.
PAMs were utilized on this portion of the site because the soil type (Silty Clay Loam) is erodible and comprised of fine particles. Therefore, the sediment basin is likely to be ineffective without the addition of PAMs. In general, PAMs are very soil specific; therefore, the on-site soils must be tested to assure proper function of the system. Also, the sediment basin receives runoff from both concentrated flows and sheet flow. Therefore, specific hydrologic information is required to determine the number and location of PAM logs.

Construction Details

Include all details from Phase 1.

Specifications and drawings should be provided for the PAM treatment system and Phase 2 sediment basin.