Engineering, Planning
Landscape Architecture
and Environmental Science
MILONE & MACBROOM®

October 25, 2013

Mr. Ernest Steinauer, Chairman
Nantucket Conservation Commission
2 Bathing Beach Road
Nantucket, MA 02554

RE: Baxter Road Temporary Stabilization Application
Town of Nantucket
Nantucket, Massachusetts
MMI #2967-11-4

Dear Chairman Steinauer and Members of the Conservation Commission:

As you may know, in addition to performing engineering review of the Sconset Beach Stabilization Project on behalf of the Conservation Commission, Milone & MacBroom, Inc. (MMI) has been assisting the Nantucket Public Works Department in evaluating measures to protect and relocate Baxter Road. At this time, it is apparent that any viable option for permanently stabilizing the road and infrastructure cannot be completed before this coming winter season. In light of this, the town is seeking to temporarily protect the existing Baxter Road in the areas where it is in imminent danger of failure. It is this protection that is the subject of this current application.

This letter is intended to provide one document that describes the project goals, construction methods, potential impacts, and mitigation and is intended to supersede and replace previous supporting materials for this application. The following information is presented:

1. Project Background
2. Project Purpose and Goal
3. Regulatory Framework for Application Request
4. Alternatives Analysis
5. Description of Proposed Activity (including sand volumes and flanking)
6. Construction Methodology
7. Monitoring and Maintenance
8. Failure Criteria and Removal

1. Project Background

The town has been advised by Town Counsel that it is legally obligated to provide access to the properties on Baxter Road. During the winter storms of 2013, significant retreat of the Sconset Bluff occurred, leaving the top of bank as close as 30 to 40 feet to the edge of Baxter Road in several areas and 60 to 70 feet in many others. While erosion rates can vary substantially from year to year, another storm season similar to 2013 could render the road impassable and/or public water supply breached, leaving the residences at the north end landlocked and the town unable to provide fire protection and safe drinking water. If this were to occur, the town would not be able to provide emergency services to these properties.

The Sconset Beach Preservation Fund, Inc. (SBPF) has proposed various stabilization measures at the toe of the slope, with the most recent application requesting authorization for hard armoring. There had been some hope that construction of the SBPF project would occur in fall 2013, which would mitigate the town's concerns regarding the roadway and utilities; however, in August it became clear that the SBPF construction project would not occur this year. At that point, the town's Public Works Department began aggressively seeking methods to protect those sections of Baxter Road that appear in imminent danger of failing during this winter season.

2. ***Project Purpose and Goal***
   The goal of the project is to maintain vehicular access and utility service to the residential properties on Baxter Road from Bayberry Lane north to the Sankaty Head Lighthouse property. Work is limited to those areas where Baxter Road appears in imminent danger of failure from bank failure. Specifically, these areas are 85 to 107a Baxter Road. Work under this application is specifically proposed as temporary and intended to provide a minimum but adequate level of protection for the short term while long term solutions are explored and implemented. The town requests that the measures proposed consider a design life of about five years.

3. ***Regulatory Framework for Application Request***
   The town is seeking to complete the repair work in question as a "limited project" under 310 CMR 10.24(c) 2. The project is needed to protect the health, safety, and welfare of the residents of Baxter Road north of Bayberry Lane and consists of the protection, maintenance, and improvement of an existing public roadway and public utilities.

4. ***Alternatives Analysis***
   Baxter Road Protection - MMI completed an alternatives analysis specific to protecting Baxter Road, and this is included as Attachment A to this letter. Given the town's project goal of protecting Baxter Road, we sought methods of stabilizing the roadway from the top of the slope (by driving sheet piling along the right-of-way) rather than at the toe; however, this was ultimately deemed infeasible due to the geology of this bluff. We made this determination using data and information provided by Haley & Aldrich (a Boston-based geotechnical and structural engineering firm with an excellent reputation throughout New England for the quality of their work) that indicates the bluff consists of a glacial till and clay material above a lens of loose poorly graded sand that is structurally unstable. This is evident in the boring logs that are presented in Attachment B.

   The information provided by Haley & Aldrich makes two critical points. The first point is that the presence of poorly graded sand at the base of the bluff suggests there is little to no cohesion and, therefore, little to no structural stability in this layer of material. The second point is that the glacial till and clay deposits present in the upper bank indicate that driving sheeting would be difficult if not impossible to do without risk of causing a failure of the bank. This is detailed in a Haley & Aldrich memo included in Attachment C.

   Soft protection, such as drift fence, snow fence, and similar measures, was not considered appropriate for this area because, although it can work, it does not provide the type of protection needed in the lengthy or successive storm events that can occur in this location.

   Hard armoring such as the revetment proposed by SBPF was not considered appropriate for the temporary stabilization. While stone armoring, seawalls, and similar hard armoring may be valid and appropriate long-term stabilization mechanisms, hard armoring would be more difficult to implement in the short period of time afforded before the winter storm season begins, and most raise concerns about removability. Further, simply moving the road and utilities is not an option. There is no room within the existing town right-of-way that would allow for moving them any meaningful amount, and any long-term solution will require relocating them. Although the water is being moved from the east to the west side of the road, this is not considered a solution to the problem.

Geotube Alternatives - Ultimately, the alternatives analysis led to the conclusion that geotubes are the only viable means of temporary protection of the bluff. Within the geotube option, there are three potential methods as described below:

- Geotube Alternative 1 – Jute Fiber Logs: The use of jute to create the logs was considered for this application since this has been used in the past on Sconset Beach with some moderate success. As we have observed in recent years, once the jute rips, as it is designed to do, the failure can be difficult to control. As sand is lost, the logs fail, which results in loss of the toe and collapse in the bank above the logs. The geotextile material is not as susceptible to ripping as the jute and, if torn, the geotextile can be repaired more readily. Ultimately, we have requested to use geotextile to create the logs because this material offers greater stability and ease of repair; therefore, it should reduce the possibility of the failures that have occurred in the past during multiday or quick-succession storms.

  Advantages of Jute: Natural material that degrades over time
  Disadvantages of Jute: Degradation of material weakens the entire system resulting in continued bank failure; degradation of material makes repair difficult.

- Geotube Alternative 2 – Three-Geotextile-Tube Configuration: The first plan called for three geotubes with the lowest tube set essentially on the existing beach and the top tube extending to elevation 26.0 Mean Low Water (MLW). The three-tube design was put forth in an effort to reduce the project footprint and impact for the temporary installation. However, the reduced impact would also result in a less robust system that would be more susceptible to failure due to toe scour. Consideration was given to compensating for the lack of stability with an enhanced monitoring and repair program but, ultimately, this design was rejected by the project team due to the lack of scour protection afforded at the toe of the geotube.

  Advantages of Three-Tube Design: Less overall impact to beach from construction and maintenance while providing some protection for the short term
  Disadvantages of Three-Tube Design: Less robust design may lead to premature failure of the system due to toe scour.

- Geotube Alternative 3 – Four-Geotextile-Tube Configuration: The preferred alternative for toe stabilization and proposed in this request is the placement of four 45-foot diameter geotubes, with the bottom tube buried in the beach to elevation 0.0 MLW and the top tube set at elevation 26.0 MLW. The bottom tube and scour apron are buried to mitigate for localized toe scour that will inevitably occur at the base of the structure. The U.S. Army Corps of Engineers (USACE) recommends designing for a scour depth of 1.5 times wave height. The 1% annual chance breaking wave height at the structure toe is estimated at five feet. Using the USACE guidelines, the predicted scour depth may be up to 7.5 feet. This is approximately equal to the 0.0 MLW elevation selected for the base.

The Federal Emergency Management Agency has set the 1% annual chance wave elevation to 26.0 MLW in the project area. The geotubes are set to this elevation to reduce the potential for overtopping during a major storm event.

The preferred design calls for the tubes to overlap, providing an effective slope of 2 horizontal:1 vertical to mitigate wave reflection with a scour apron and four-foot-diameter anchor tube extending five feet seaward of the lowest log at elevation 0.0 MLW. This results in encroachment of the geotubes of approximately 40 feet seaward of the toe of the slope, plus five feet for the scour apron and anchor tube. An estimated 20 feet of the encroachment will occur above the summer beach profile, with the remaining 25 feet below grade. Efforts have been made to reduce the encroachment onto the beach to the extent possible. This includes reducing the width of the scour apron from 10 feet to five feet and steepening the geotube logs slightly to further limit encroachment on the beach. The design as presented attempts to balance the wave reflection caused by a steeper shoreline system with minimizing encroachment onto the beach.

Advantages of Four-Tube Design: More robust than three-tube system and less susceptible to toe scour
Disadvantages of Four-Tube Design: Requires excavation on beach; encroaches further into beach (horizontally and vertically) than the three-tube design

5. ***Description of the Proposed Activity***
The application consists of placing approximately 1,500 linear feet of geotubes extending from 85 Baxter Road to 107a Baxter Road. While initial application materials proposed two distinct sections of tubes only at the locations where roadway failure appears imminent and where no structures currently exist, the issue of flanking cannot be resolved in the gap area between the two systems. Therefore, the application materials request a continuous run of geotube from 85 Baxter Road to 107a Baxter Road.

The proposed plan is a geotextile tube configuration that was developed in coordination with geotextile tube manufacturer Maccaferri, Inc. The MacTube® geotextile tube containers (geotubes) are made from a woven polypropylene (PP) geotextile. Manufactured in a sand color, the geotextile fabric is woven in a rip-resistant weave pattern for maximum resistance to mechanical damage. The system will consist of four tubes, each with a 45-foot circumference (approximately 19 feet wide and 6.5 feet tall). The tubes will be 100 or 200 feet long through the project area, with returns set at a 45-degree angle constructed with 50-foot-long tubes. Following construction of the tubes (see below for construction methodology), sand cover will be provided, and nourishment will be performed to protect the tubes and mitigate for loss of the bank as a sediment source. Aside from providing adequate nourishment, maintaining cover over the tubes is critical to maintaining their life expectancy since the geotextile is prone to degradation from ultraviolet light. Sand fill will be secured from on-island sources of compatible sand.

The embankment above the toe shows evidence of rill erosion from rainfall and runoff from the grass areas along the top. The town is working with the property owners to reduce runoff that discharges over the top of the slope and will provide a low berm along the easterly side of the roadway to direct water toward Baxter Road. This will only be completed in areas where the roadway contributes to flow of water over the bluff. In addition to redirecting runoff, jute netting will be placed on the bank face to protect the exposed soil. Netting will be placed this fall immediately upon receipt of approval to proceed. In the spring, native plantings (e.g., beach grass and woodier species) will be added to the slope to further reduce erosion.

Sand Nourishment Criteria: Sand for nourishment will be provided from on-island sources. Attachment D is sieve analysis data from the on-island sources in comparison to existing bank and beach material as taken from applications submitted to the commission by SBPF. Immediately following placement of the tubes, a minimum of two feet of sand cover will be provided over the top of the geotube, creating a bench that extends approximately 20 feet from the bank and slopes down the beach at 2.5 horizontal:1 vertical. This results in a sand application rate of approximately 14.3 cubic yards per linear foot for the 1,500-linear-foot installation.

Sand replenishment will occur periodically through the project life as needed. Winter replenishment will occur at a rate of one cubic yard per linear foot when 50% of the height of the bottom tube is exposed. Each spring (before April 30), the two feet of sand cover will be re-established over the geotubes.

The overall sand volume to be used in the project is as follows:

Placement Location	Rate of Placement (CY/LF)	Length of Placement (Feet)	Total Volume (CY)
Inside Geotubes	4.22 (each tube)	1,500	25,320
Leveling Sand	2.3	1,500	3,450
Nourishment Sand	14.3	1,500	21,450
		TOTAL VOLUME	50,220

Structure Flanking: As with any coastal structure that retards beach erosion, flanking of the geotubes is a critical concern. Ideally, the tubes would be excavated into the banks at each end but, given the temporary nature of the proposed project and the invasiveness of such excavation, we are not currently proposing this. As noted in the inspection protocols (below), observations for flanking will be made regularly. To minimize the possibility of flanking, additional nourishment sand will be placed at the ends of the tubes. If substantial retreat of the adjacent bank occurs and nourishment is no longer an appropriate response, then additional geotubes will be considered to fill any gapping that develops. If geotubes are considered the most appropriate response, then an application to the Conservation Commission will be made prior to implementation.

6. *Construction Methodology*

As previously mentioned, construction of the geotube system will be completed at the toe of the existing Sconset Bluff between 85 and 107a Baxter Road, with installation starting at the most endangered sections (based on distance of the edge of the bluff to the road) in case weather or other factors prevent full installation this season. The geotubes will be filled in place with sand to the proper volume. Compacted sand backfill will be used behind each geotube layer to provide a flat stable bench for the next subsequent layer of geotube. The total system will be four geotubes high and will be covered with a sacrificial sand layer to a top elevation not to exceed +28.0 feet MLW and extending down the foreshore slope on a 1 vertical:2.5 horizontal slope to meet existing grade. Frequency of renourishment of the sacrificial sand layer will depend on the duration that the temporary protection is left in place and the severity/occurrence of storms.

The construction period will extend an estimated eight weeks, with one week of setup and installation of approximately 800 linear feet of tube per week on average. For example, it would take slightly less than two weeks to construct the 1,500-foot-long bottom tier. The following construction sequence is proposed for the work under this application:

1. The existing beach within the footprint of the bottom geotube and scour apron layer will be graded to elevation 0.0 MLW and to achieve a maximum 1.5% slope in any direction. Given the variations in the beach profile, this will require varying amounts of excavation along the beach as noted in the cross sections shown on the project plans.
2. Approximately five feet to the seaward side of the bottom geotube layer will be excavated to an elevation of 0.0 feet MLW for installation of the four-foot circumference anchor tube and attached scour apron. This section will then be backfilled to the original beach elevation.
3. The scour apron will be rolled out toward the bluff and the bottom geotube placed on top of the apron at the appropriate distance from the slope. The scour apron is delivered in 60-foot-wide rolls and will be overlapped by 10 feet at the vertical seams.
4. Sand will be supplied by on-island sand pits, trucked to Baxter Road and placed in a slurry mixer at the top of the slope. Water to create the slurry will be obtained from an existing fire hydrant in the project area. Details on the slurry delivery are provided below.
5. The slurry will be pumped from the top of the bank through a six-inch-diameter hose and into the geotubes on the beach. Sand will remain in the tubes, and clean water will filter through the membrane. The water will infiltrate through the beach.
6. The bottom geotube will be filled with the sand slurry mixture until the tube achieves the required volume and exterior dimensions.
7. The scour apron will then be pulled seaward over the top of the recently filled geotube. The area behind the geotube, between the tube and the bluff, will be backfilled and compacted with 12-inch lifts of clean sand fill. The fill will be installed to an elevation matching the top of the filled geotube.
8. The scour apron will then be pulled landward over the newly backfilled section, and the next geotube layer will be placed upon the scour apron. This next geotube layer shall be staggered so as to provide an effective slope of 2 horizontal:1 vertical with the upper layer overlapping the previously placed geotube layer.
9. Steps 5 – 8 are repeated for the remaining geotube layers.
10. Once all geotubes are filled, the entire structure will be covered with a clean sand fill. The sand cover will be a minimum of two feet in depth at a 1 vertical: 2.5 horizontal slope to meet the existing beach profile along the front of the geotube structure.
11. Following construction, the beach will be restored to its current elevation (if construction impacts necessitate repair) using beach sand from the site. No material from the on-island sand pits is expected to be used for postconstruction beach repair.

Construction Access: Equipment will access the beach from Hoicks Hollow. A long-armed excavator will be used along with a skid steer on the beach. Any fueling of these machines will happen in the Hoicks Hollow parking lot area. All other equipment will operate out of the staging area located at 99 and 101 Baxter Road.

Staging Area for Slurry Production: The lots at 99 and 101 Baxter Road including portions of the Baxter Road right-of-way (not travel way) will be used as a staging area for the construction. Vegetation will be removed from these lots in those areas where slurry sand will be delivered.

This is necessary to ensure that no grass or woody debris is mixed with the sand, which will result in clogging the slurry pumps. A 30- or 40-cubic-yard roll-off dumpster will be used to mix the slurry, which will be approximately 80% water and 20% sand. Water will be pumped from the fire hydrant located in front of 97 Baxter Road into this dumpster. The flow will be regulated by a valve at the dumpster. An excavator will constantly feed sand into the gate end of the dumpster. Inside the dumpster will be an agitating pump that will create the slurry as it pumps the water at the same rate it is being delivered to the dumpster, down into the geotubes via a six-inch hose.

The sand will be delivered to the staging area via standard 20-cubic-yard dump trucks. They will dump just along the seaward side of the roadway creating a windrow, or continuous series of piles. A small bucket dozer will push the sand down to the excavator, which will constantly feed the slurry production. The roadway will be swept clean daily, and a police detail will be hired to manage any traffic impacts.

Haley & Aldrich has been consulted relative to the weight of the dumpster and the sand stockpiling that is proposed for this area and, as long as a minimum distance of 25 feet is maintained from the top of the bank, it has been determined a safe staging area.

The slurry will be delivered down the face of the bluff via a slurry hose, which will pump directly into the ports of the geotubes. The water will leach from the geotubes as they fill with sand. A small berm will be constructed on the beach on the waterward side of the geotubes to prevent water from discharging down the beach unmitigated.

<u>Template Sand Delivery</u>

The staging area that was used for the slurry will later be used for the delivery of the sand template. For this phase of the work, the sand will be pushed over the top of the bluff with a dingo (a small hand-operated, walk-behind dozer style piece of equipment) or by a conveyor. Once the face of the bank is vegetated in spring 2014, future sand delivery will be accomplished through the use of three-foot-diameter polyethylene pipes.

Once the sand is delivered to the geotubes below, a skid steer and/or a bucket dozer will work to spread the sand evenly over the entire system. These machines will not drive directly on top of the geotubes until they have a sufficient sand cover, requiring the machines to work their way further outward from the central delivery point(s).

For future maintenance and nourishment sand deliveries, material will be delivered directly to the two end points as well as to some central locations. By delivering a volume of sand to the end points, a skid steer or bucket dozer will be able to build a ramp, similar to how the existing terraces are accessed. The sand would then be pushed inward from the end points until it gets to more central delivery locations, at which point it will continue to push sand toward the middle. The bench on the top of the geotube system will be a minimum of 20 feet wide, easily facilitating this activity.

As part of the annual nourishment in the spring, sand will similarly be pushed down the face of the system with a grading technique until the system is again fully covered and the template is back to a 1 vertical: 2.5 horizontal slope.

Truck Traffic

Dump trucks with a 20-cubic-yard capacity will deliver compatible sand to the site from a local pit(s). Given the volume of sand required and the capacity of the trucks, approximately 2,500 truck trips will be required to complete the project. Over the eight-week construction cycle, this will average 63 trucks per day, or six trucks making 10 round trips to the site. Following construction, ongoing deliveries for nourishment will require fewer truck loads.

7. ***Monitoring and Maintenance Requirements***

The geotube installation will be visually inspected monthly and following significant storm events throughout its life. The inspection will consist of:

1. Photodocumention of the condition of the geotube and nourishment sand
2. Observation of the sacrificial sand layer to determine if replenishment is needed
3. Identification of the location of any exposed geotextile
4. Identification of any repair required to the geotextile
5. Visual observation of the ends of the tubes to determine if flanking is occurring

Results of the inspection will be submitted in writing to the Town of Nantucket Public Works Director. If inspection reveals that repair work is needed, the Public Works Director will coordinate having this completed as soon as possible. The schedule of repair will be determined based upon the severity of the work required. For example, repair of torn geotextile will be completed as soon as the beach is accessible for such activity. Sand replenishment will be completed as soon as appropriate based on weather conditions and time of year.

If the commission would like to have updrift and downdrift impacts monitored, the town would be amenable to modifying the monitoring plan to include the following:

- Year 1 transect surveys in locations previously performed by Woods Hole Group in April and August
- Year 2 through 5 transect surveys in locations previously performed by Woods Hole Group in April

The monitoring data will be used to estimate the volume of nourishment sand remaining on the geotubes as well as the accretion of sand on downdrift beaches. Results of the monitoring will be compiled into an annual report in April of each year documenting the data collection and analysis and recommending a nourishment protocol. The frequency and volume of nourishment will be determined annually based on observed site conditions. Following determination of the proposed nourishment volume, a written report will be submitted to the Conservation Commission documenting performance of the nourishment layer over the past year and outlining the additional sand volume to be provided in that nourishment cycle.

8. ***Failure Criteria and Removal***

As with any coastal structure, there is potential this system will fail. We define failure as the following:

- Complete loss of one or more tubes
- Greater than 50% section loss of one or more tubes. Tearing of a log would not be considered failure unless more than 50% of the fill material is lost.
- Flanking that leaves greater than 10% of the tube length exposed at each end and that is not mitigated by nourishment
- Excessive change in updrift or downdrift beach cross section. Quantitative failure for updrift and downdrift impacts is difficult to develop with certainty at this time. If annual transects suggest changes are occurring as compared to historic data collected by SBPF over the past 15+ years, the Department of Public Works will meet with Conservation Commission staff and determine if they believe the changes are a result of the project, and an appropriate course of action will be determined.

In the event of failure, the following will occur:

1. The Conservation Commission will be immediately notified through its staff.
2. Following mutual agreement by the Department of Public Works and the Conservation Commission staff, the logs will be cut and removed. Removal will require use of an excavator or similar equipment on the beach to pull the geotextile up, leaving the sand in place.
3. Following removal of the geotextile, the sand will be spread along the toe of the slope and left in place.

This protocol will also be followed to remove the structures at the end of the permit life.

It should be noted that if a large section of geotextile is lost (which is extremely unlikely given the durability of the material) it would sink to the ocean floor rather than float. In the event this does occur, the town will notify the Conservation Commission to determine if retrieval is necessary and, if retrieval is required, an appropriate course of action.

We appreciate the Conservations Commission's consideration of this application and look forward to discussing this with you in more detail on October 30, 2013.

Very truly yours,

MILONE & MACBROOM, INC.

Nicolle E. Burnham, P.E., CFM
Principal

Enclosures:
Attachment A – Baxter Road Stabilization Alternatives Analysis
Attachment B – Boring Logs
Attachment C – Haley and Aldrich Memorandum Regarding Sheet Pile Installation (DRAFT)
Attachment D – Sand Source Data and Analysis

cc: Kara Buzanoski, Public Works Director

2967-11-4-o2513-ltr.docx

BAXTER ROAD TEMPORARY STABILIZATION
NOI SUBMISSION

BAXTER ROAD
NANTUCKET, MASSACHUSETTS

October 25, 2013

LOCATION MAP:

PROJECT SITE VICINITY MAP:

SCALE 1" = 500'

PREPARED FOR:

TOWN OF NANTUCKET
NANTUCKET, MASSACHUSETTS

LIST OF DRAWINGS

SHEET NO.	TITLE
1	TITLE SHEET
2	EXISTING CONDITIONS
3	GENERAL PLAN
4	TYPICAL CROSS SECTION
5-9	CROSS SECTIONS

PREPARED BY:

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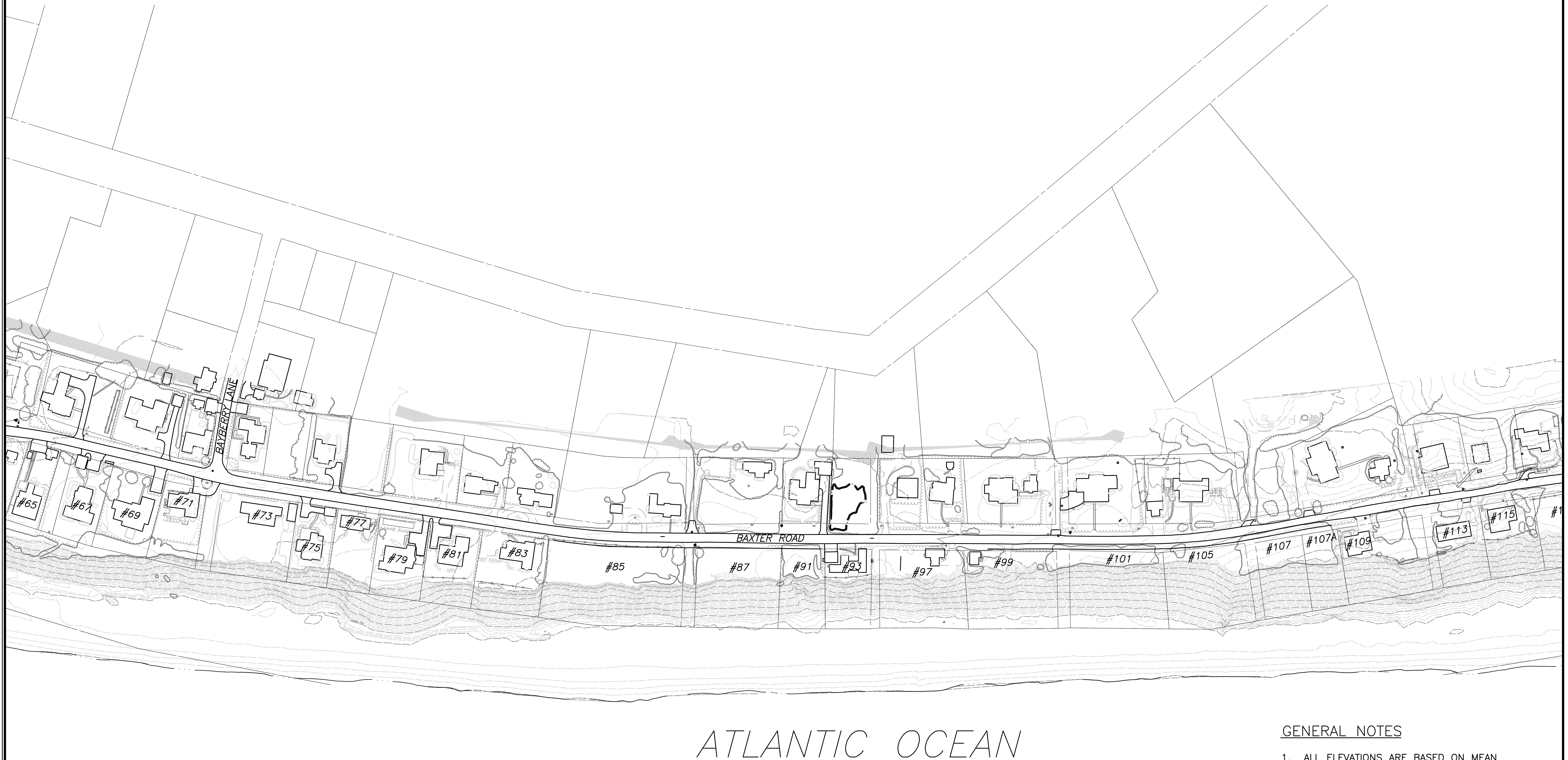
DESIGNER: MILONE & MACBROOM, INC.

BY: James Macbroom

DATE: October 25, 2013

P.E. NO.: 43052

DRAFT



GENERAL NOTES

1. ALL ELEVATIONS ARE BASED ON MEAN LOW WATER DATUM (M.L.W.=0.0').
2. CONTOURS SHOWN IN 2 FOOT INTERVALS.
3. EXISTING TOPOGRAHIC SURVEY INFORMATION SHOWN ON THIS PLAN TAKEN FROM A LIDAR SURVEY PROVIDED BY COL-EAST AND BLACKWELL & ASSOCIATES, INC. PERFORMED ON JULY 15, 2013, AND CAN ONLY REFLECT CONDITIONS AS THEY EXISTED AT THE TIME OF THE SURVEY.

FOR PERMITTING PURPOSES ONLY

0' 50' 100'
0 1/4" 1/2"

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DESCRIPTION	DATE	BY

EXISTING CONDITIONS - TEMPORARY SLOPE STABILIZATION

BAXTER ROAD
SLOPE STABILIZATION

NANTUCKET, MASSACHUSETTS

DESIGNED	DRAWN	CHECKED
RSD	SMW	---

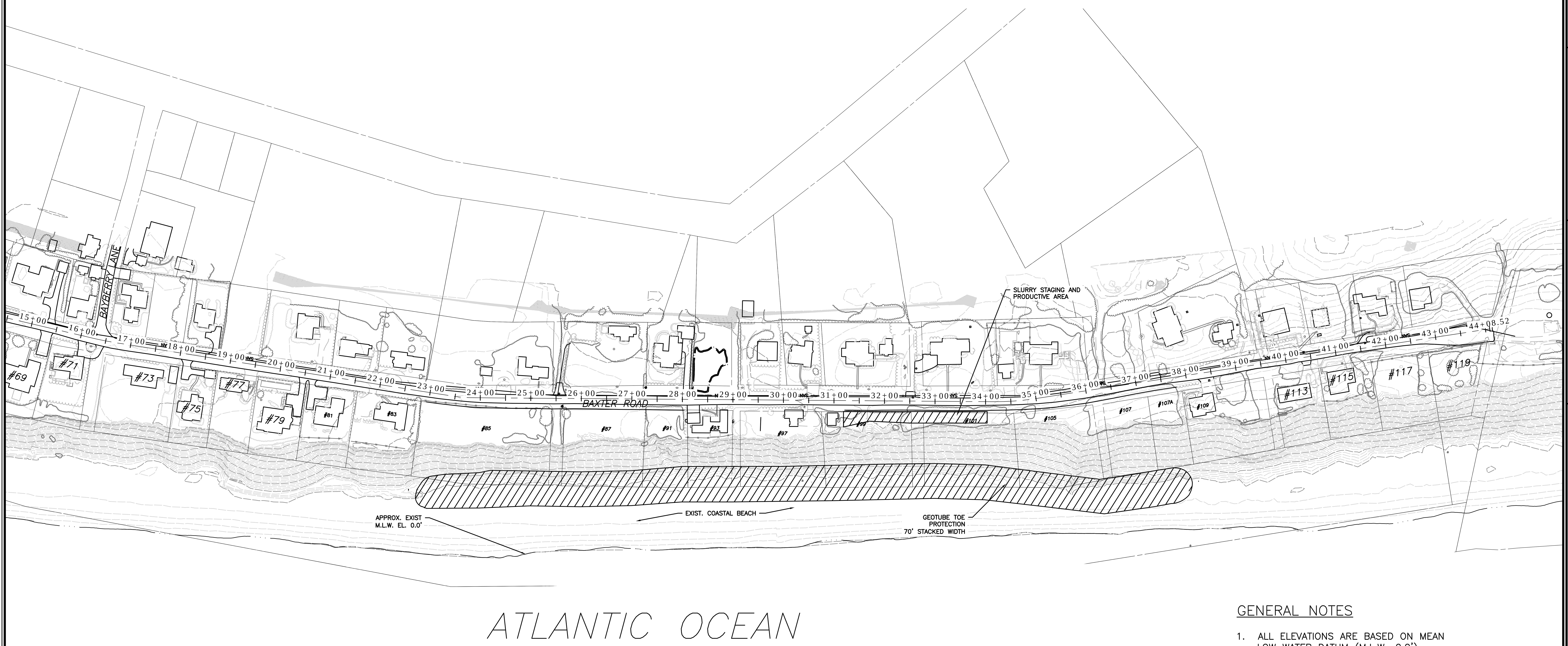
SCALE: 1" = 200'

DATE: OCT. 25, 2013

PROJECT NO.: 2967-11

SHEET NO.: 2 OF 9

SHEET NAME: EXIST.



NOTE:

LENGTH =1,500 LF
AREA OF IMPACT = 105,320 SF

GENERAL NOTES

1. ALL ELEVATIONS ARE BASED ON MEAN LOW WATER DATUM (M.L.W.=0.0').
2. CONTOURS SHOWN IN 2 FOOT INTERVALS.
3. EXISTING TOPOGRAHIC SURVEY INFORMATION SHOWN ON THIS PLAN TAKEN FROM A LIDAR SURVEY PROVIDED BY COL-EAST AND BLACKWELL & ASSOCIATES, INC. PERFORMED ON JULY 15, 2013, AND CAN ONLY REFLECT CONDITIONS AS THEY EXISTED AT THE TIME OF THE SURVEY.
4. LIMITS OF SAND COVER OVER THE GEOTEXTILE TUBES NOT SHOWN FOR CLARITY. FOR LIMITS SEE TYPICAL SECTION ON SHEET 4 AND CROSS SECTIONS SHEETS 5 THRU 9.
5. GEOTUBE LIMITS, ELEVATIONS AND SLOPE IS BASED ON DESIGN PROVIDED BY MACAFFERI AND OCEAN & COASTAL CONSULTANTS.

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DESCRIPTION	DATE	BY

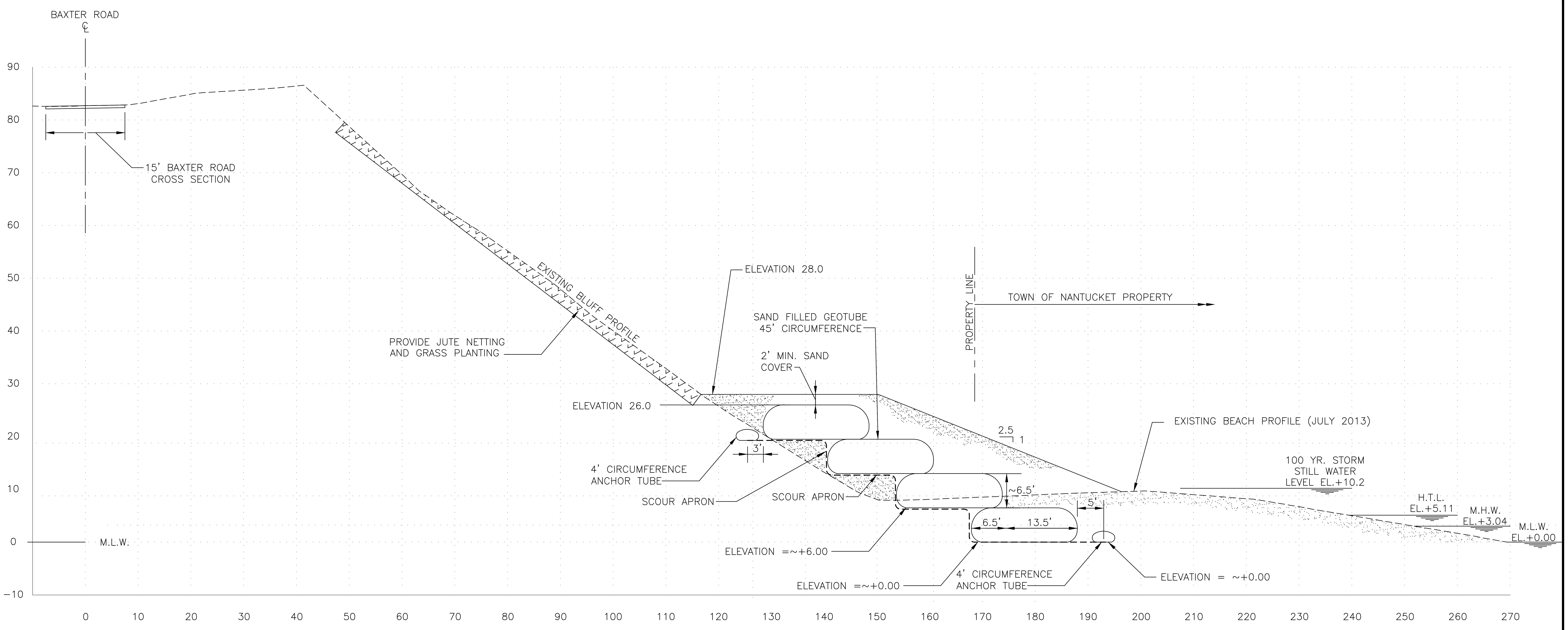
GENERAL PLAN - TEMPORARY SLOPE STABILIZATION

BAXTER ROAD
SLOPE STABILIZATION

NANTUCKET, MASSACHUSETTS

DESIGNED	DRAWN	CHECKED
RSD	SMW	---

SCALE: 1" = 200'
DATE: OCT. 25, 2013
PROJECT NO.: 2967-11
SHEET NO.: 3 OF 9
SHEET NAME: GEN



TYPICAL SECTION – GEOSYNTHETIC TUBES

GENERAL NOTES

1. THIS GEOTEXTILE TUBE SLOPE PROTECTION IS SUBMITTED FOR TEMPORARY SHORT–TERM STABILIZATION OF THE BLUFF ENVIRONMENT AND IS NOT INTENDED TO BE INSTALLED AS A PERMANENT STRUCTURE.
2. ALL ELEVATIONS ARE BASED ON MEAN LOW WATER DATUM (M.L.W.=0.0').
3. GEOTEXTILE TUBES SHALL OVERLAP IN STEPPED LAYERS WITH THE WIDTH OVERLAPPED TO PROVIDE AN EFFECTIVE SLOPE OF 2:1.
4. SLOPE OF GEOTEXTILE TUBE STACK SHALL NOT BE STEEPER THAN 1:2.
5. GEOTEXTILE TUBE FABRIC SHALL BE MACCAFERRI MACTUBE OS 500, OR APPROVED EQUAL, WITH EITHER A COMPOSITE OR SHROUD ATTACHED TO THE TOP OF THE GEOTEXTILE TUBE WHERE EXPOSED TO ELEMENTS.
6. SCOUR APRON SHALL BE APPROXIMATELY 60' WIDE SO AS TO EXTEND ALONG THE BOTTOM CONTOUR OF STACKED GEOTEXTILE TUBE CONFIGURATION.
7. SAND BACKFILL SHALL BE PLACED IN 12" LIFTS AND COMPACTED PRIOR TO PLACEMENT OF UPPER GEOTEXTILE TUBE LAYER, SO AS TO PROVIDE A FLAT STABLE BENCH FOUNDATION FOR THE GEOTEXTILE TUBE INSTALLATION.
8. CONTRACTOR SHALL UTILIZE CONSTRUCTION TECHNIQUES WHICH ELIMINATE THE POSSIBILITY OF RIPPING/PUNCTURING GEOTEXTILE TUBE SYSTEM.

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(413) 241-6920 Fax (413) 241-6911
www.miloneandmacbroom.com

DESCRIPTION	DATE	BY

TYPICAL CROSS SECTION - TEMPORARY SLOPE STABILIZATION

BAXTER ROAD
SLOPE STABILIZATION
NANTUCKET, MASSACHUSETTS

DESIGNED	DRAWN	CHECKED
RSD	SMW	---

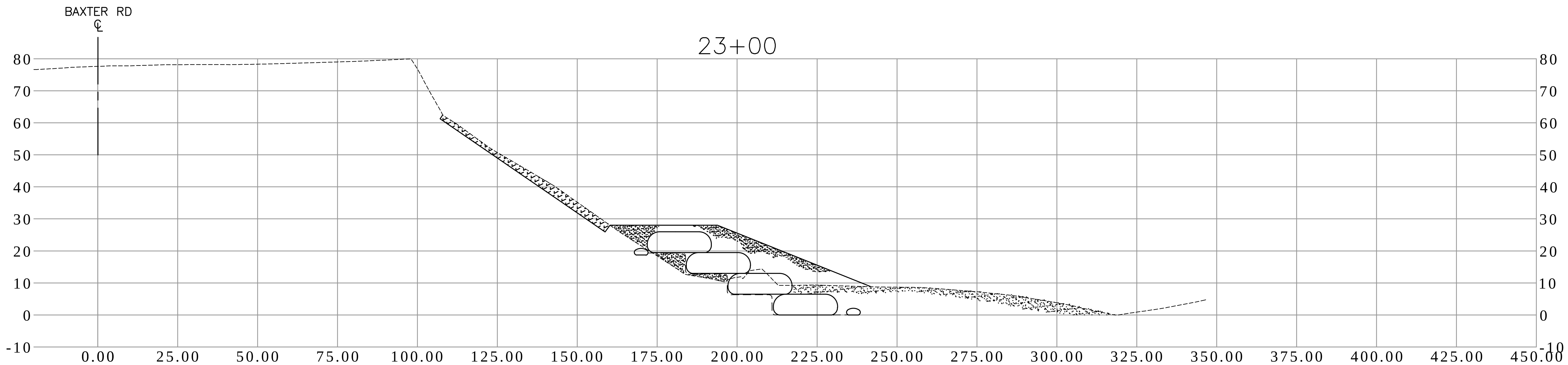
SCALE: HOR: 1" = 20' VERT: 1" = 20'

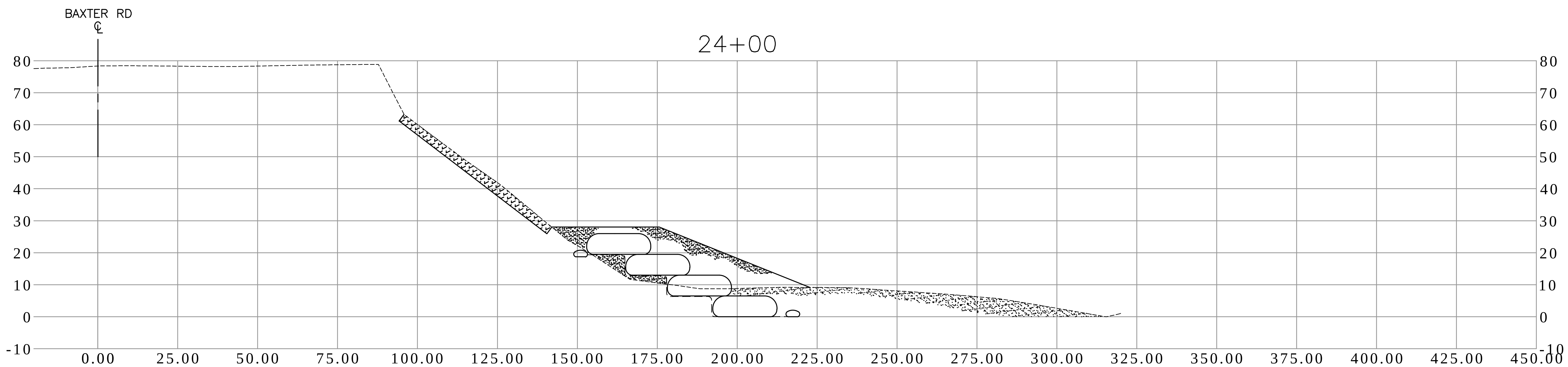
DATE: OCT. 25, 2013

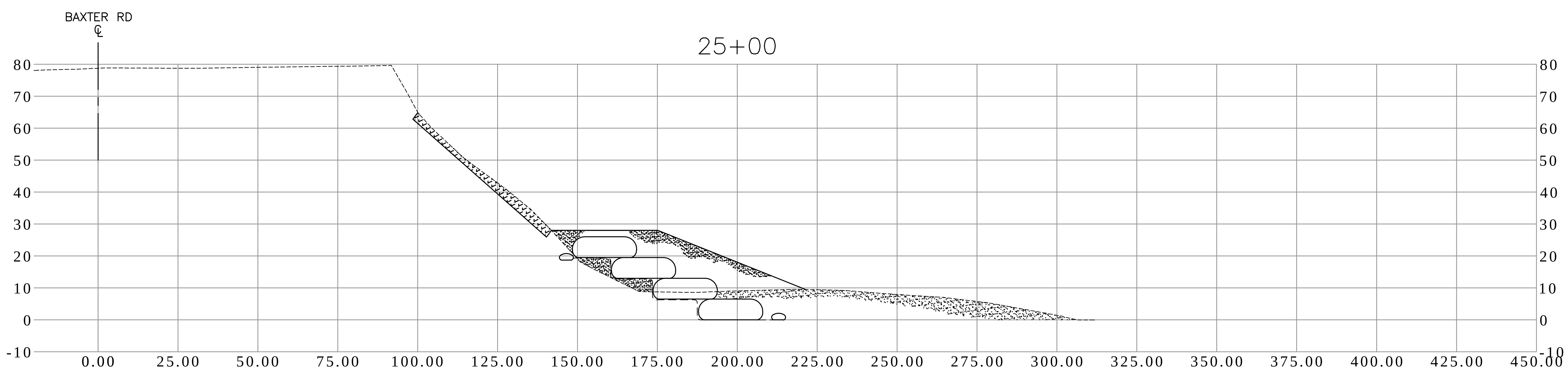
PROJECT NO. 2967-11

SHEET NO. 4 OF 9

SHEET NAME: TYP







FOR PERMITTING PURPOSES ONLY

0' 10' 20'
0 1/4" 1/2"

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DESCRIPTION	DATE	BY

CROSS SECTIONS - TEMPORARY SLOPE STABILIZATION

BAXTER ROAD
SLOPE STABILIZATION

NANTUCKET, MASSACHUSETTS

DESIGNED	DRAWN	CHECKED
RSD	SMW	---

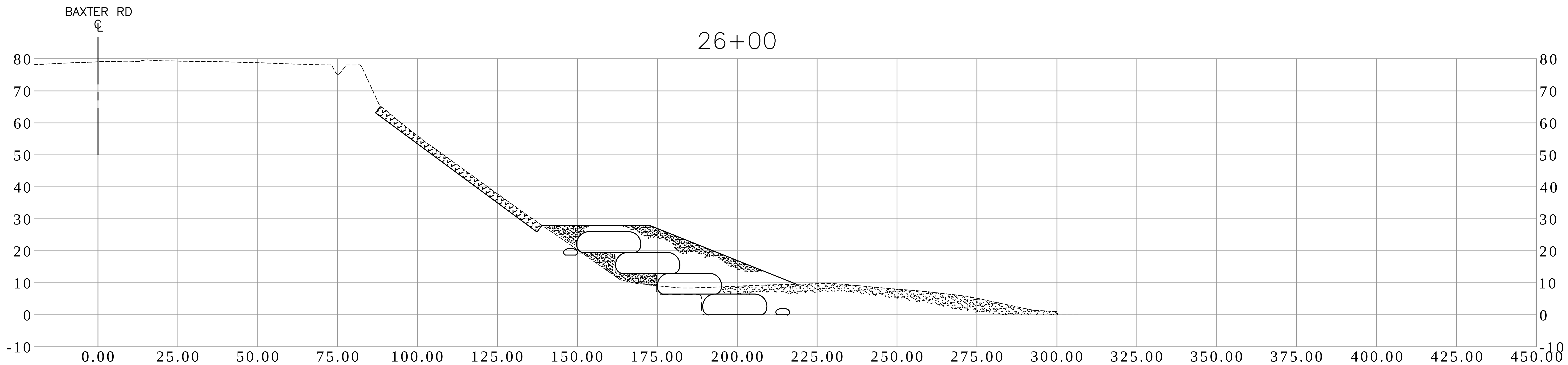
SCALE: HOR: 1" = 40' VERT: 1" = 40'

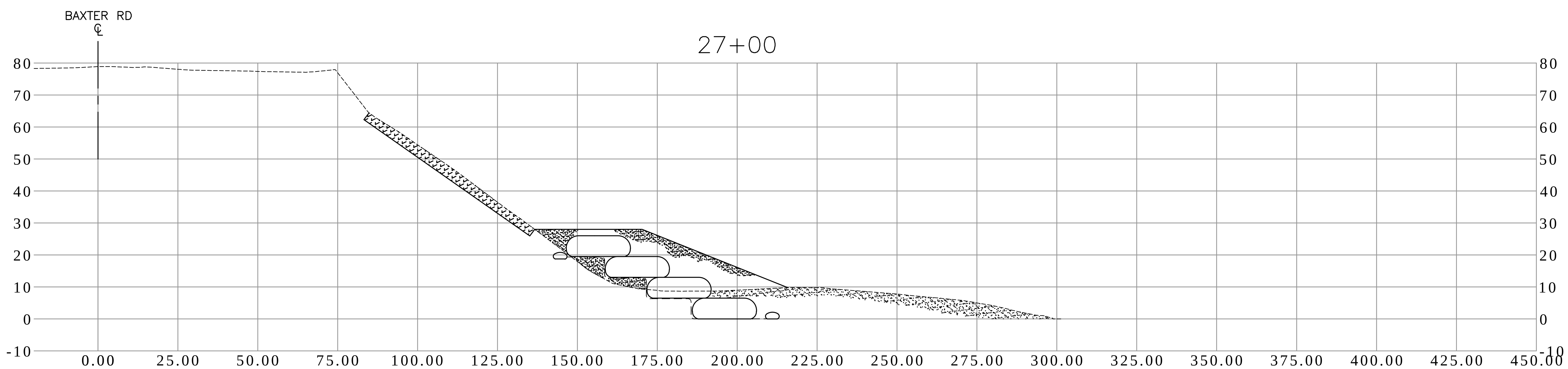
DATE: OCT. 25, 2013

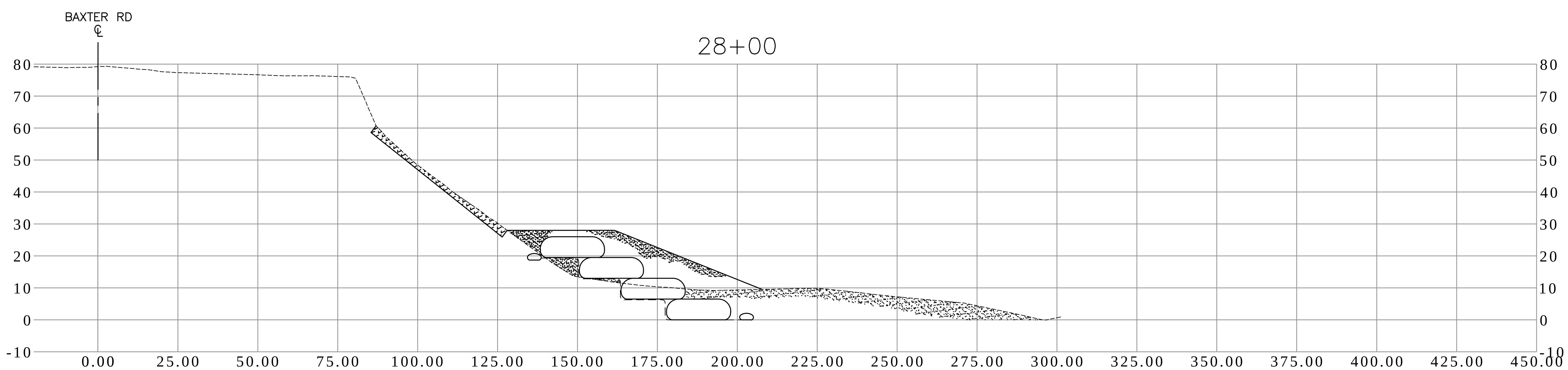
PROJECT NO.: 2967-11

SHEET NO.: 5 OF 9

SHEET NAME: X-SECTION







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DESCRIPTION	DATE	BY

CROSS SECTIONS - TEMPORARY SLOPE STABILIZATION

BAXTER ROAD
SLOPE STABILIZATION

NANTUCKET, MASSACHUSETTS

DESIGNED	DRAWN	CHECKED
RSD	SMW	---

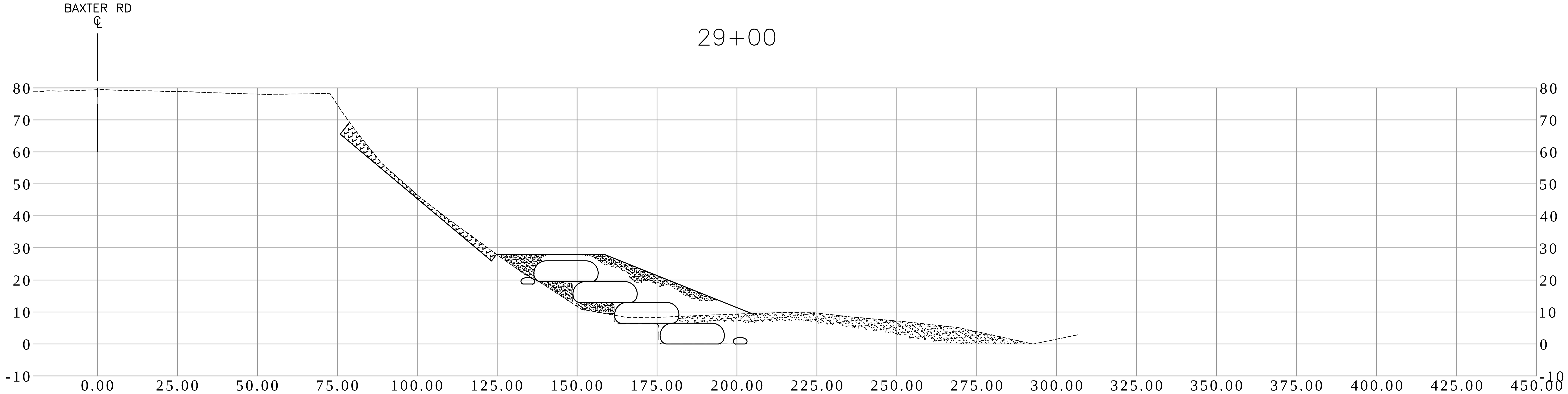
SCALE: HOR: 1" = 40' VERT: 1" = 40'

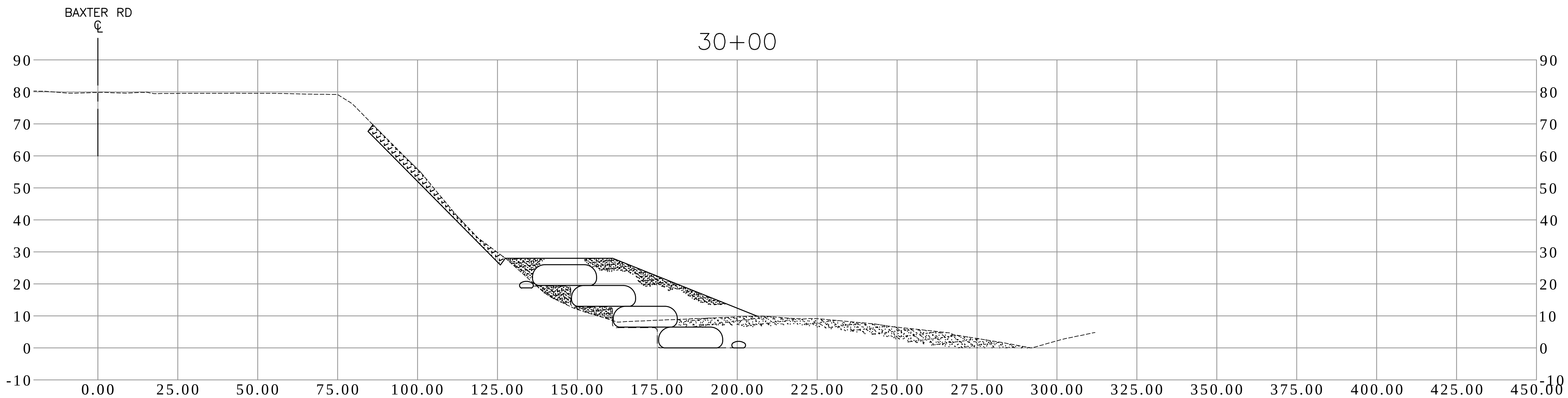
DATE: OCT. 25, 2013

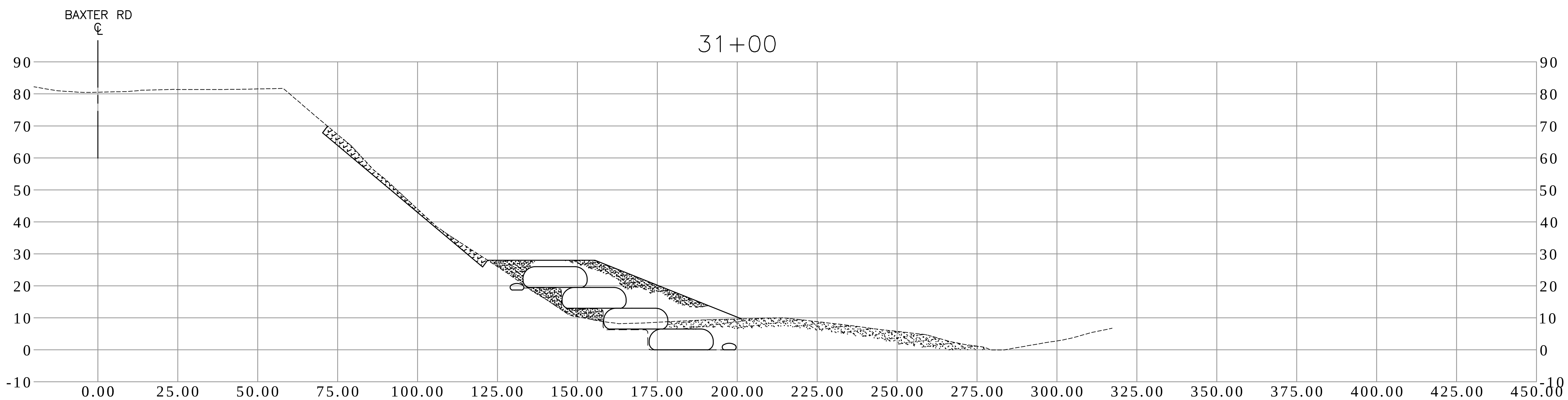
PROJECT NO.: 2967-11

SHEET NO.: 6 OF 9

SHEET NAME: X-SECTION







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CROSS SECTIONS - TEMPORARY SLOPE STABILIZATION

BAXTER ROAD
SLOPE STABILIZATION

NANTUCKET, MASSACHUSETTS

DESIGNED	DRAWN	CHECKED
RSD	SMW	---

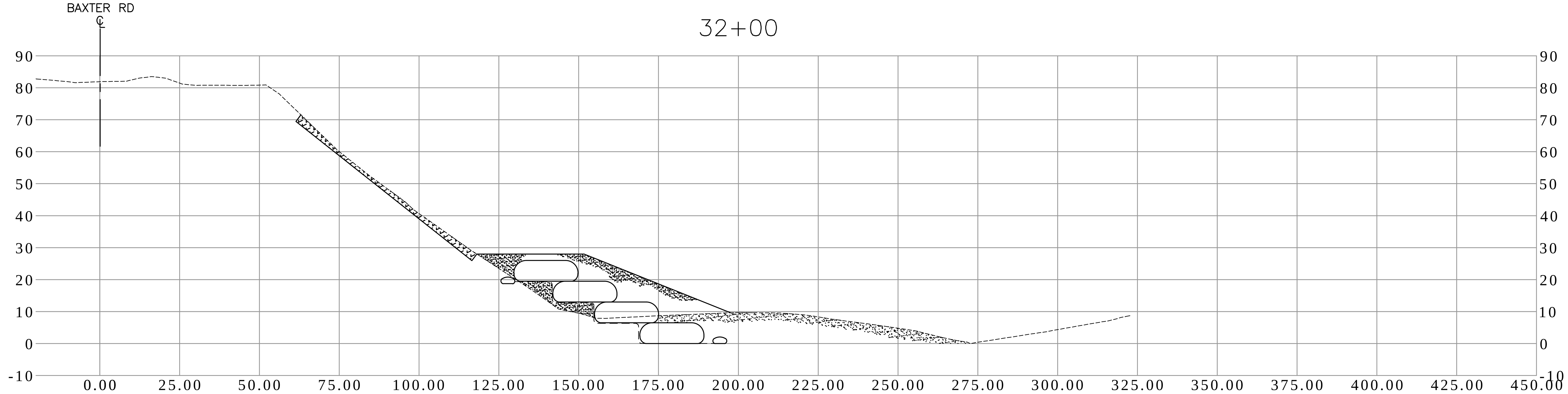
SCALE: HOR: 1" = 40' VERT: 1" = 40'

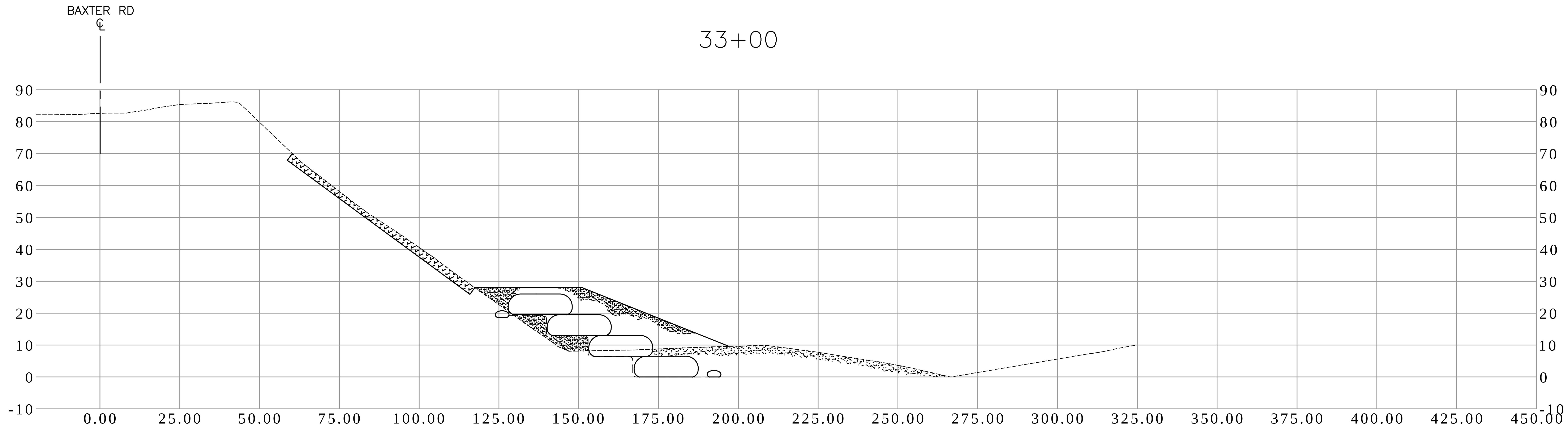
DATE: OCT. 25, 2013

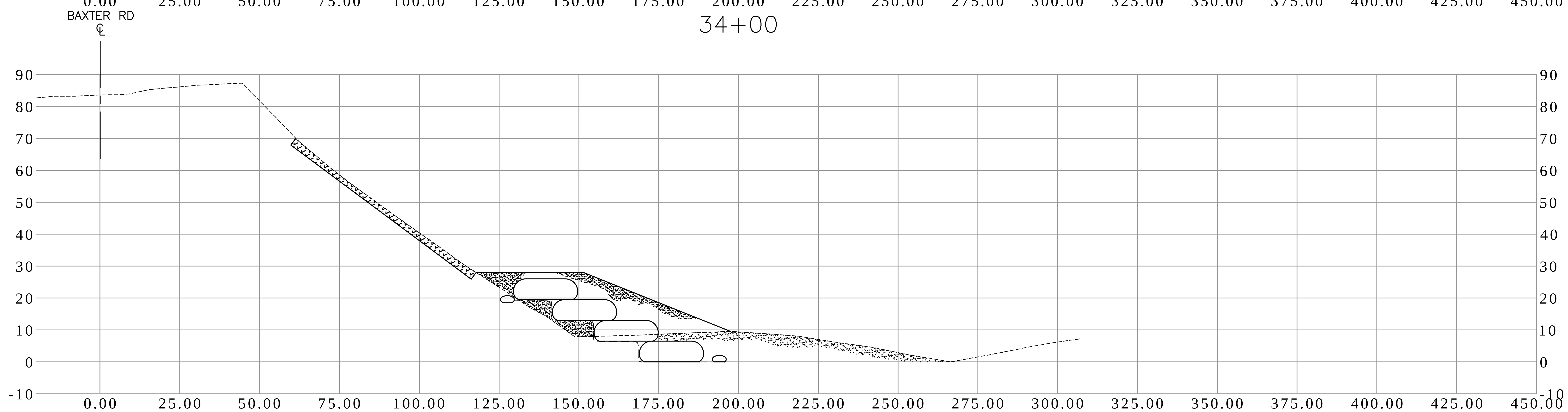
PROJECT NO.: 2967-11

SHEET NO.: 7 OF 9

SHEET NAME: **X-SECTION**







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CROSS SECTIONS - TEMPORARY SLOPE STABILIZATION

BAXTER ROAD
SLOPE STABILIZATION

NANTUCKET, MASSACHUSETTS

DESIGNED	DRAWN	CHECKED
RSD	SMW	---

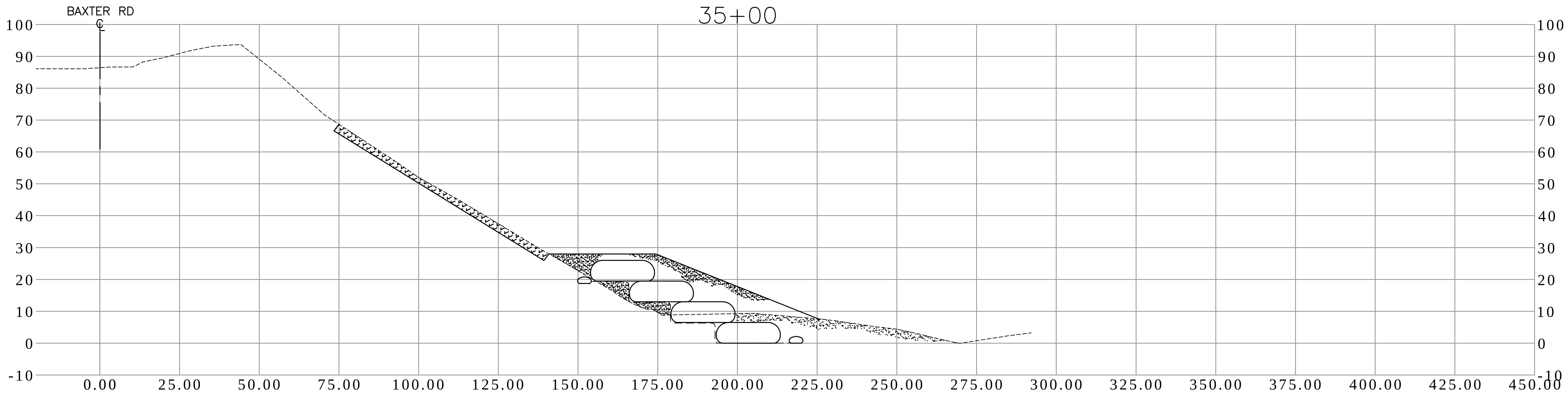
SCALE: HOR: 1" = 40' VERT: 1" = 40'

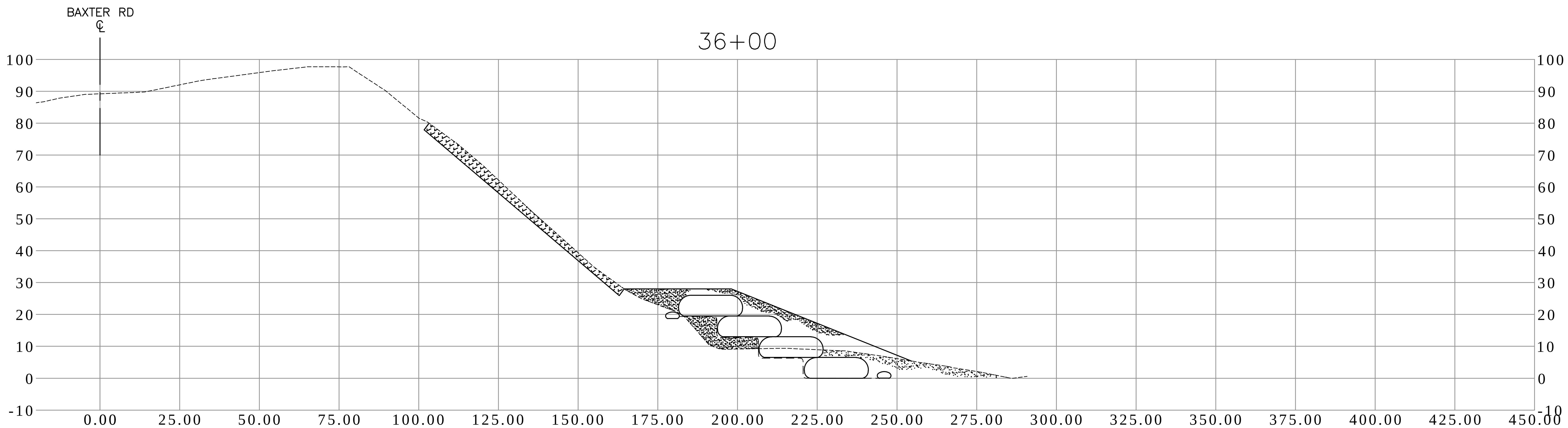
DATE: OCT. 25, 2013

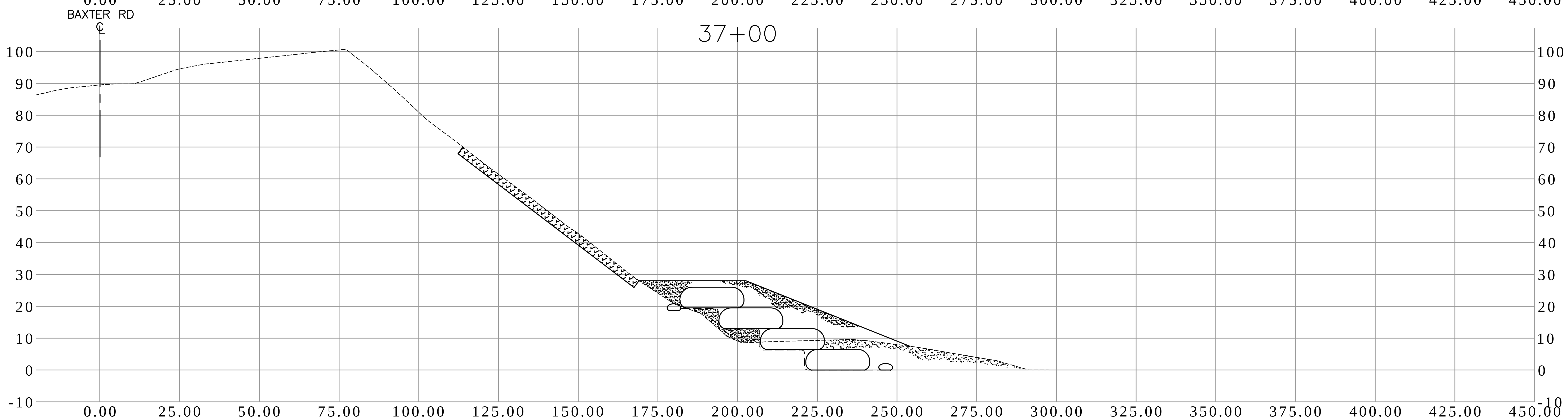
PROJECT NO.: 2967-11

SHEET NO.: 8 OF 9

SHEET NAME: X-SECTION







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CROSS SECTIONS - TEMPORARY SLOPE STABILIZATION

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RSD	SMW	---
DESIGNED	DRAWN	CHECKED

SCALE: HOR: 1" = 40' VERT: 1" = 40'

DATE: OCT. 25, 2013

PROJECT NO.: 2967-11

SHEET NO.: 9 OF 9

SHEET NAME: **X-SECTION**