Gully Stabilization and Stormwater Mitigation at The Health Center, Plainfield Final (100%) Design Report Plainfield, Vermont

February 19, 2020

Prepared for: Central Vermont Regional Planning Commission 29 Main Street, Suite 4 Montpelier, Vermont 05602

MMI #4069-08

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ENGINEERING | PLANNING | LANDSCAPE ARCHITECTURE | ENVIRONMENTAL SCIENCE

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1.0 EXISTING CONDITIONS

1.1 <u>Project Background</u>

This report describes the final design (100% complete) of a stormwater improvement at the The Health Center, Plainfield in Plainfield, Vermont. This project builds on a concept design completed during the Central Vermont Stormwater Master Plan for Barre Town, Barre City, and Plainfield in 2018. This project was selected to move forward as one of the top 5 projects identified during town wide master planning. The concept design included regrading to temporarily store water, remove sediment, and slow velocities entering the existing gully in addition to stabilizing the side slopes of the gully. The design will stop the gully from continuing to move uphill therefore reducing the risk to the existing stormwater pond and reduce sediment migration to the Winooski River.

Milone & MacBroom was hired by the Central Vermont Regional Planning Commission to further develop the concept design through final design so that the project is construction ready. Results of field analysis and basis for the preliminary design are summarized in this report.

1.2 Existing Site Conditions

Milone & MacBroom has conducted multiple field visits in spring, summer, and fall 2019 to assess existing conditions at the site, determine site constraints, collect GPS information of key features, and understand opportunities and constraints. Site conditions were documented (Appendix A). Site survey and topographic mapping was obtained from the The Health Center, Plainfield to serve as project base mapping. Data collected during field visits was used to update existing conditions mapping. Other available mapping of natural resources and regulated areas was reviewed and added to base mapping.

Gully erosion has occurred behind The Health Center between the existing stormwater pond outlet and the Winooski River floodplain. This erosion has been increased by the concentrated stormwater leaving two stormwater pipe outlets and forming an intermittent stream that travels through the gully area. The initial steep slope from the stormwater pond down to the beginning of the gully erosion is covered in riprap and currently stable. Mass failure of gully walls has occurred from the end of the riprap slope to the beginning of the downstream floodplain. The gully area side slope soils are steep and erodible with slopes ranging from 2:1 to a short stretch of nearly vertical side slope. The majority of the gully side slopes have some vegetation established that is holding side slope soils in place. Over time trees have fallen into the gully. Those trees on the gully floor and coarse stones exposed from the eroded soils have combined to provide grade control on the gully floor and slowed downward erosion.

The site was visited with George Springston a Geology Professor and statewide expert on gully and landslide processes who was able to report on deep headcuts that have previously traveled up the gully and have now been arrested at the downstream end of the existing riprap slope. A new headcut exists just downstream of the gully in the lower portion of the channel, which is expected to move uphill if not arrested. Historic aerial photos from 1967 show that the gully existed prior to the The Health Center's existence. The gully has deepened, widened, and a four-



foot-tall headcut has traveled up the gully to the base of the stone slope since a 2011 visit from George Springston.

Soils observed in the gully were of erodible sand/ fine sand / silt in layers. Coarser material including gravel, cobble, and some boulders have accumulated on the bottom of the gully and side slope toe providing some resistance to erosion. The soils in the area are not well represented by Soil Survey mapping due to the many different layers deposited by glacial Lake Winooski. Soil testing was not be completed as infiltration practices are not included in the design.

Without active stabilization, gully side slopes are expected to continue to erode to reach their natural angle of repose overtime. If not stabilized, the bottom of the gully and side slopes are expected to destabilize and erode further as the existing and additional future headcuts travel up the gully. Sediment from the gully bottom and side slopes travels directly to the downstream Winooski River channel.

Japanese Barberry (*Berberis thunbergii*) is present on the site and is classified by the state as a Class B Noxious Weed. Barberry is located in clumps within and around the gully. This plant has a poor root structure and outcompetes other native plants that have roots that better stabilize soils.

1.3 <u>Hydrology</u>

Untreated stormwater is piped to the upstream end of the gully and discharged near where The Health Center's stormwater pond exits. Stormwater from impervious surfaces on The Health Center property is collected and routed through the existing stormwater pond on the property before discharging into the gully. Additional untreated stormwater from offsite is also collected and discharged into the top of the gully. Untreated runoff is collected from part of part of Towne Avenue and the post office, a section of Route 2, and uphill areas across Route 2 including a portion of Route 214 and residential and agricultural properties.

The watershed was delineated using one-foot LiDAR contours and refined by walking key boundary areas in the field (Appendix B).

Return Interval (years)	Flow (cfs)
2	6.8
5	13.5
10	21.0
25	34.3
50	47.5
100	64.0

TABLE 1 Peak Flow Estimates

The area that contributes drainage to the gully is 36.4 ac with 5.3 acres of impervious cover (14.6% impervious cover). The stormwater pond drains 2.9 ac from The Health Center site, while the remaining 33.5 ac bypass the pond and discharge directly into the gully. The Water Quality Volume of the entire watershed is 0.56 acre-feet (24,444 cubic feet) and 0.54 acre-feet (23,591



cubic feet) for the portion of the watershed not going through The Health Center stormwater treatment system. Peak flows were estimated using a hydrology model developed in HydroCAD (Table 1).

1.4 <u>Site Constraints</u>

The available space and steep slope are the largest site constraint at the project area. The area available for stormwater storage is bounded by the existing stormwater pond and steep forested slopes. This is the only location available due to the location and low elevation of the stormwater outlets. The depth of the exiting stormwater pipes outfalls is also a constraint to space and access, fixing the beginning point of the settling areas approximately halfway down the steep bank.

Infiltration stormwater practices are not appropriate for the project site. Soils are mapped as hydrologic soil group C and D, which are not ideal for infiltration. The only area available for stormwater settling is on a 20% slope.

There are no known utilities or other infrastructure within the project area that are not specifically related to the existing stormwater conveyance infrastructure.

The existing uses at The Health Center limit construction access and staging from the east.

2.0 PRELIMINARY DESIGN

2.1 <u>Basis of Design</u>

The design builds on the concept design to meet project goals to dissipate energy from the stormwater discharge pipes, maximize the water quality benefits of reduced erosion and sediment transport, and minimize operation and maintenance needs.

Construction of a regraded stormwater settling area and rock berm was chosen due to the slope of the existing area and to maximize the storage volume. The access and grading are difficult. Settling area side slope and berm slopes were maintained at a maximum of 1.5:1 slope and 3:1 where maintenance vehicles will access the area. The detention volumes are maximized for the space available to allow for the maximum storage volume for settling solids and slowing flow to the gully entrance. The stormwater settling area has a total of 3,467 cubic feet of storage volume with a maximum ponding depth of 3 feet. Two existing stormwater pipes leading to the new settling area will need to be cut back to provide more space. Elevation of the berm was set to ensure that the stormwater pipes will not be backwatered. There will be no change to the existing stormwater pond except to regrade and reapply stone riprap to the downstream slope and outlet channel.

A stone riprap filter berm is proposed to control the water surface elevation in the stormwater settling area. The riprap has been sized to be resilient to the 100-year storm based on calculated velocities. Riprap has been chosen as a berm material due to its resistance to erosion at high velocities and low maintenance needs. If stones are displaced over time the maintenance crew will be able to redistribute the stones to repair any erosion damage using typical excavation



equipment. This is a change from the 30% concept design which suggested using gabion basket walls, which would require more specialized and expensive maintenance if they were damaged.

Gully stabilization is proposed to include bio-engineering and strategic placement of existing wood to stabilize the gully walls with a naturalistic approach working around the areas that already have stable side-slopes to minimize future construction impacts. This is a change from the 30% concept design which suggested grading the gully side slopes to a 2:1 slope. Active excavation within the gully area would destabilize the side slopes that have stabilized and are in the process of stabilization.

Manual labor by landscape professionals will be used to strategically add stabilization to the gully side slopes in the form of horizontal application of coir fiber erosion logs and plantings of native trees and perennials to supplement the areas where the slopes have not yet healed. Resistance to erosion and the ability to trap sediment on the bottom of the gully will be increased by strategic placement of large wood logs on the gully bottom. Existing down trees and selection of trees that are expected to fall from the top of the gully slope and further destabilize the bank will be used as a source of wood. This approach minimizes sediment mobilization caused by construction and access activities, minimizes heating caused by removal of shade, and benefits from the natural stabilization that has begun on some of the slopes. This approach does not eliminate sediment movement and erosion within the gully, as the side slopes may continue to move over time, but provides roughness to minimize the potential for future widespread sediment migration. Specific locations for log placement have been specified on the plans. Vegetation has been specified to reestablish tree, shrub, and herbaceous plants on the gully banks. Existing vegetation will be preserved and supplemented with new plantings. A seed mix has been chosen with Native Vermont species and an annual fast-growing seed to help establish stabilization in the first season. A mix of native early and late successional tree species, hardwood and evergreen have been chosen to maximize long-term success.

Removal of invasive species is recommended as part of the design. Japanese Barberry (*Berberis thunbergii*) is a small deciduous shrub 2-8 feet tall growing in dense stands in and at the top of the gully banks. This plant is classified by the state as a Class B Noxious Weed. It is recommended to hand pull or use a pry bar to uproot the plants and transport them to a landfill for disposal. These plants will be replaced with native plants with more robust root structures.

The design is expected to have a 50-year design lifetime, assuming the operation and maintenance plan is followed.

2.2 Cost Estimate

A preliminary cost opinion was calculated as an estimate of construction costs to be \$210,000 including construction, a 15% construction continency, and engineering services for bid and construction phases (Appendix D). This estimate includes an estimation of engineering services and permit application fees to obtain the permits assumed to be required for the project (Section 3.0).



2.3 <u>Construction</u>

Construction access is proposed across the agricultural parcel to the west of the project site. This location would minimize disruption to the busy operations and well-maintained landscaping at The Health Center. Access would be located off of Route 2 at the existing farm entrance, through the gate in the wooden fence, across the pasture, and through the temporary agricultural fence at the corner of the field, and across an existing lawn area to the north end of the project site. An additional access pathway to deliver trees and stabilization materials to the lower part of the gully can be made with smaller vehicles from the west side of the agricultural field and through an existing forest access path to the middle west side of the gully. No tree removal would be required along these access corridors. All access areas would be restored to original or improved condition as part of the project.

Construction of the stormwater settling area is expected to be completed by an excavation contractor. Equipment would include a tracked excavator that will access the entire stormwater settling area and on-road haul trucks that will travel to the edge of the stormwater settling area to remove fill and deliver stone. A smaller vehicle such as a bobcat, farm tractor, or gator could be used to deliver materials to the edge of the gully for stabilization. No construction vehicles would enter the gully area in order to minimize new disruption of soils and slopes.

2.4 **Operation and Maintenance**

Short term and long-term operation and maintenance are critical to the ongoing success of a project and to ensure the expected water quality goals are met. The Town of Plainfield has preliminarily agreed to responsibility for the operation and maintenance of the project and will reconfirm that responsibility as the project moves forward. Landowners have preliminarily agreed to allow the Town the necessary access to the site to perform operation and maintenance needs and this will also need to be confirmed and formalized as the project moves forward. Operation and Maintenance Plan Notes are included on the Design Plans (Appendix C).

Access to the site is recommended across the agricultural parcel to the west of the site, as is shown on the design plans for construction. This agreement will be drafted by the grantee for implementation and signed by the landowners and party responsible for operation and maintenance, i.e., the Town.

The expected frequency and level of effort of the operation and maintenance has been estimated based on drainage area, watershed landuse, Operation and Maintenance Plan requirements, and previous project experience to include:

- Annually a person should go look at site to look at sediment accumulation, displaced rocks, and erosion for approximately one hour. Additional visits should occur after very large storms.
- Sediment build up in stormwater settling areas will occasionally need to be dug out. This can be expected approximately every five years. These visits would be approximately half a day with the road crew, an excavator, and a truck to haul away sediment. The Town will need to rent an excavator to complete the work, as the current equipment owned by the Town cannot access the settling areas. An excavator can travel down the 3:1 slope, turn



at the access landing area, and drive into the bottom of the stormwater settling area. With a moderate size excavator the material in the settling area can be piled on the slope from below and then loaded into a truck from the top of the slope, moving the sediment twice before loading. The material can be placed on the treeline edge of the agricultural field adjacent to the access road. Sediment accumulation rate has been estimated at approximately 4.2 CY/year and guides the estimated cleanout frequency (Appendix E).

• The gully will be low maintenance and might need a half day of tree/log rearranging every 5-10 years. This is expected to be accomplished by two laborers with a chainsaw and prybars. It is expected that this area will be revegetated and low maintenance following the initial construction and first year of maintenance covered by the project.

3.0 PERMITTING NEEDS

An assessment of permit needs has been completed based on the preliminary design and discussions with regulators.

3.1 Vermont State Permitting

No Operational Stormwater Permit is expected. The Health Center site already has an existing permit (4655-9015.A). All site changes are occurring downstream of the existing onsite treatment regulated by that permit. No new impervious surface is being created as part of the project. When the existing permit is renewed information regarding the design should be submitted with the permit renewal application.

The project will need to obtain for a Stormwater Construction General Permit (3-9020) from VTDEC and is expected qualify for the Low Risk Construction activity category. The project disturbance area is 1.0 acre and will need a permit.

An Act250 Amendment is required. The site already has an existing Act250 permit (5W0427-1 and -2). The Act250 District 5 Coordinator has been contacted and confirmed this requirement. The project is within the River Corridor and project conformance with these standards will be reviewed by Rivers Program staff as part of the Act250 review process. Ned Swanberg the VTDEC Regional Floodplain Manager who reviews river corridor and floodplain areas visited the site and discussed the preliminary design plans. No concerns were identified.

No Stream Alternation Permit is required. A site visit was completed on October 3, 2019 with VTDEC River Management Engineer Patrick Ross to review potential permit needs. The gully was confirmed to be an intermittent stream that does not fall under this jurisdiction.

No wetlands permitting will be required. No wetland or wetland buffers are present within the project limits.

No permitting is required from the Vermont Agency of Transportation. It was confirmed with The Health Center and VTrans District 7 & 9 Projects Manager Shauna Clifford that the stormwater pipe leading from Route 2 is owned by The Health Center. No work will be done in the state right-of-way and therefore no 1111 permit is required.



3.2 Local Permitting

A local conditional use site plan permit amendment to the existing permit (2017-01-CU) will be required.

The FEMA floodplain is regulated by the Town, but no project elements will extend into the nearby Winooski River regulated floodplain. The River Corridor is not regulated by the Town.

3.3 <u>Federal Permitting</u>

No federal permitting is expected.









Gully Stabilization and Stormwater Mitigation at The Health Center, Plainfield

November 22, 2019 MMI #4069-08



The Health Center, Plainfield Building and Stormwater Pond



Lower Stormwater Pond and Outlet

Stormwater Pond Outlet





Riprap Slope and Two Stormwater Pipe Outlets

End of Riprap Slope and Beginning of Gully





Looking Upstream Near Station 2+00

Recent Erosional Feature from Fallen Tree (Station 2+35)



<image>

Two Fallen Trees and 3 Undermined Trees Proposed to be Added to Gully Bottom 3+60

Two Down Trees Near Station 3+90





Confluence with the Winooski River





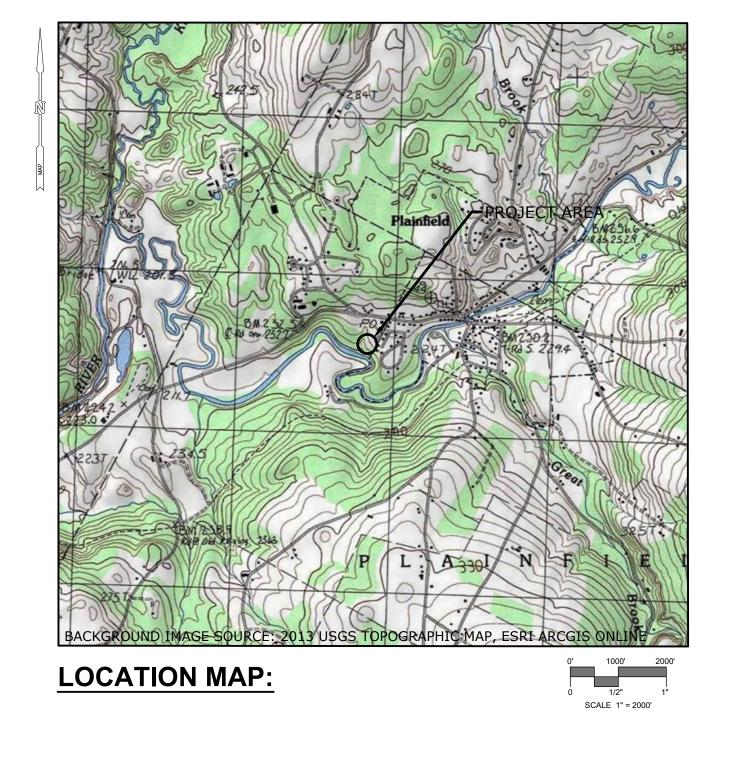






GULLY STABILIZATION & STORMWATER MITIGATION THE HEALTH CENTER, PLAINFIELD

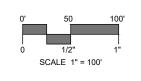




157 TOWN AVENUE PLAINFIELD, VERMONT

100% DESIGN 4069-08 FEBUARY 19, 2020

PROJECT SITE VICINITY MAP:



PREPARED BY:



PREPARED FOR:

CENTRAL VERMONT REGIONAL PLANNING COMMISSION 29 MAIN STREET, SUITE 4 MONTPELIER, VERMONT 05602

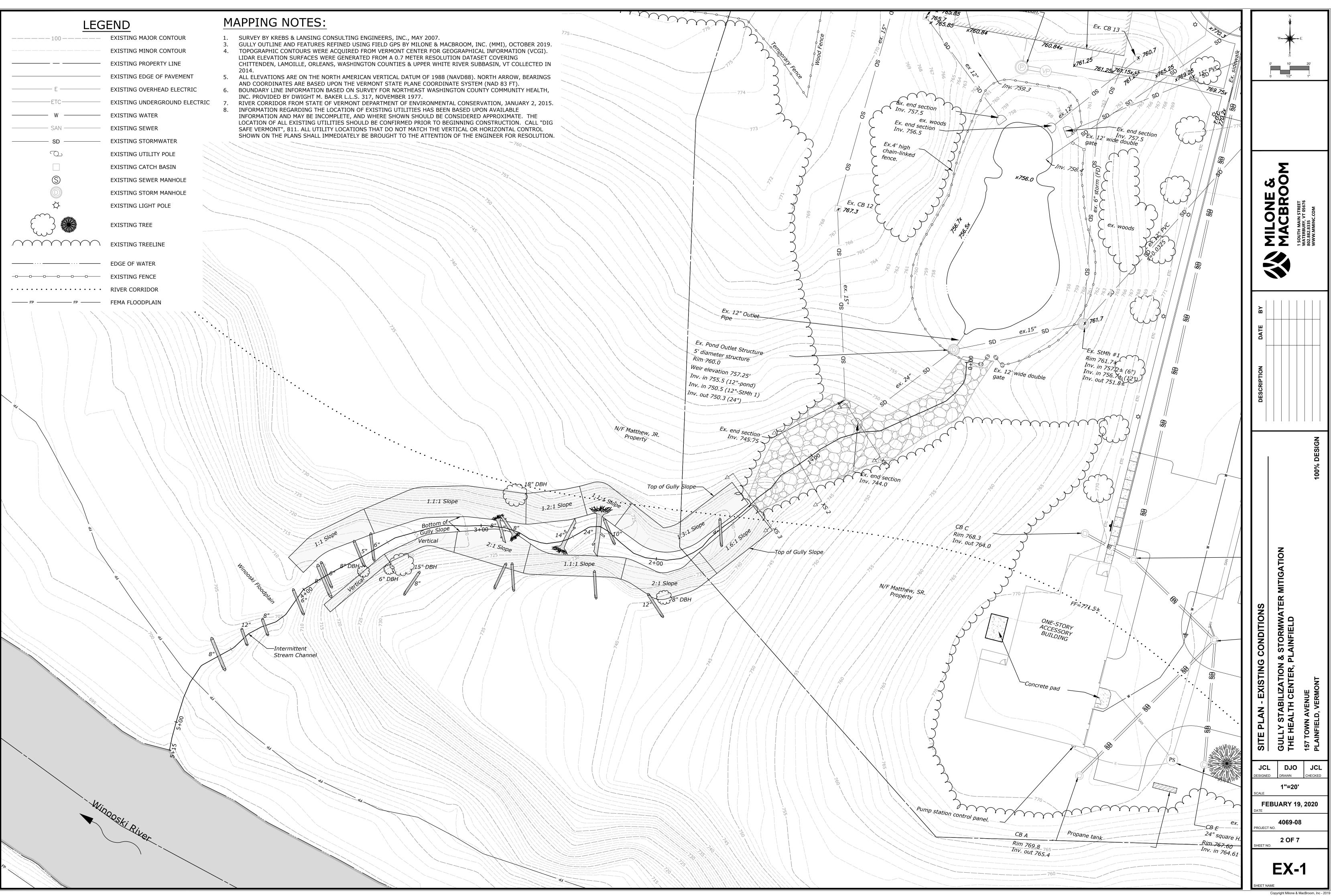
LIST OF DRAWINGS

NO.	NAME	TITLE
01		TITLE SHEET
02	EX-1	SITE PLAN - EXISTING CONDITIONS
03	PR-1	PROPOSED STORMWATER SETTLING AREA
04	PR-2	PROPOSED GULLY STABILIZATION
05	CON-1	CONSTRUCTION ACCESS
06	SEC-1	CROSS SECTIONS AND PROFILE
07	D-1	DETAILS



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FP FP	FEMA FLOODPLAIN
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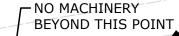
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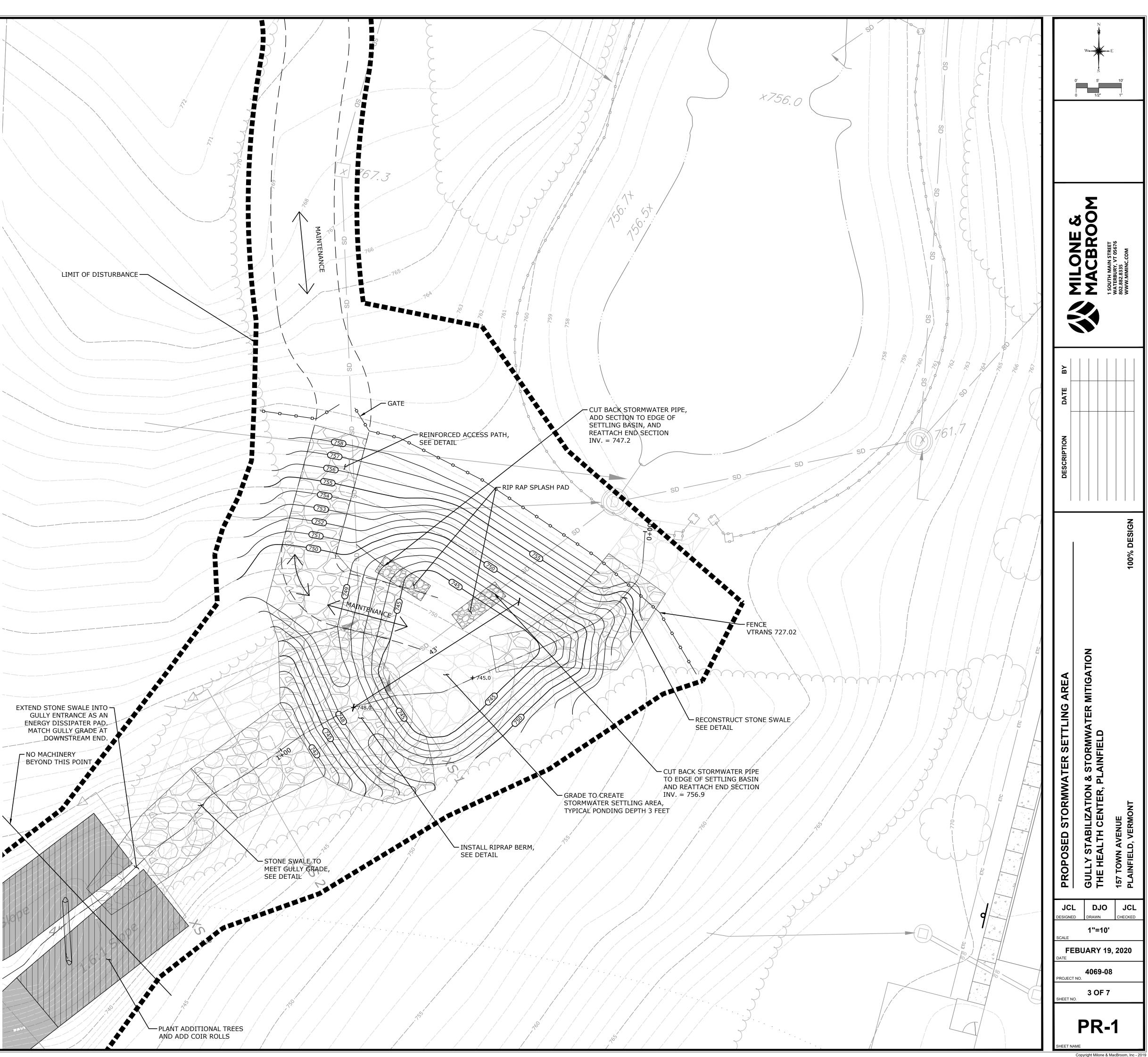
CONSTRUCTION NOTES:

- 1. THE CONTRACTOR SHALL MAINTAIN A COMPLETE SET OF PLANS ON SITE AT ALL TIMES AND FOLLOW THE SPECIFICATIONS, DETAILS, AND NOTES FOR ALL ASPECTS OF THE PROJECT. ANY CONFLICTS SHALL BE BROUGHT TO THE ATTENTION OF THE PROJECT ENGINEER IMMEDIATELY.
- 2. ALL PROPOSED GRADES AND SPOT ELEVATIONS ON THE PLANS INDICATE FINISHED GRADE. THE NEED TO MODIFY PROPOSED FINISHED GRADES MAY BE REQUIRED IF UNEXPECTED CONDITIONS ARE ENCOUNTERED (I.E. BEDROCK, LEDGE, ETC.) OR IF SIGNIFICANT CHANGES TO EXISTING CONDITIONS OCCURS.
- EARTH MOVING AND HAULING, ROCK DRILLING OR CRUSHING, AND SIMILAR EXCESSIVELY LOUD EQUIPMENT SHALL NOT BE OPERATED ON SUNDAYS OR BETWEEN THE HOURS OF 5:30 P.M. AND 7:00 A.M. EXCEPT IN EMERGENCY SITUATIONS.
- 4. AT THE END OF EACH WORK DAY, THE CONTRACTOR SHALL PROVIDE A FORM OF BARRIER OR CONSTRUCTION FENCING AT THE SITE ENTRANCE TO PREVENT MOTORIZED VEHICLE ACCESS. 5. NO DISTURBANCE BEYOND THE ESTABLISHED LIMITS IS ALLOWED UNLESS PRIOR PERMISSION IS OBTAINED.
- 6. ALL PRECAUTIONS SHALL BE TAKEN TO PREVENT THE POTENTIAL TRANSPORT OF INVASIVE SPECIES TO OR FROM THE CONSTRUCTION SITE OR SPREADING WITHIN THE SITE. THE CONTRACTOR SHALL INSPECT AND CLEAN ALL EQUIPMENT PRIOR TO TRANSPORT TO THE CONSTRUCTION SITE. 7. STOCKPILE ALL TOPSOIL AND SANDY LOAM SOILS ONSITE FOR REUSE.
- 8. ANY MATERIALS EXPORTED OFF-SITE SHALL BE LEGALLY DISPOSED OF IN AN UPLAND LOCATION AT NO ADDITIONAL COST. THE CONTRACTOR IS RESPONSIBLE FOR FINDING A SUITABLE RECIPIENT OF THE MATERIAL, GAINING REGULATORY APPROVAL IF NEEDED, AND HAULING.
- 9. ALL DIMENSIONS AND ELEVATIONS SHALL BE VERIFIED IN THE FIELD PRIOR TO CONSTRUCTION. ANY DISCREPANCIES SHALL BE BROUGHT TO THE ATTENTION OF THE PROJECT ENGINEER FOR DETERMINATION. THE CONTRACTOR IS EXPECTED TO PROVIDE FIELD ENGINEERING SERVICES DURING CONSTRUCTION TO ESTABLISH AND RECORD GRADES, LINES, AND ELEVATIONS. EXACT ELEVATIONS AND SLOPES WILL BE APPROVED IN FIELD BY THE PROJECT ENGINEER.
- 10. THE LOCATION OF ALL EXISTING UTILITIES SHOULD BE CONFIRMED PRIOR TO BEGINNING CONSTRUCTION. CALL "DIG SAFE" AT 1-888-DIG-SAFE (344-7233). THE CONTRACTOR SHALL TAKE PRECAUTIONS NOT TO DISTURB EXISTING UTILITIES.
- 11. CONTRACTOR MUST COMPLY WITH ALL APPLICABLE FEDERAL, STATE AND LOCAL PERMITS AND REGULATIONS THROUGHOUT DURATION OF PROJECT. COMPLIANCE WITH ALL CONDITIONS OF APPLICABLE AND SECURED PERMITS IS THE RESPONSIBILITY OF BOTH THE CONTRACTOR AND THE PERMITTEE. COPIES OF ALL PERMITS AND AUTHORIZATIONS SHALL BE MAINTAINED ON THE PROJECT SITE BY THE CONTRACTOR THROUGHOUT CONSTRUCTION.
- 12. ALL STORAGE AND ACCESS ROUTES, PEDESTRIAN FENCES/BARRIERS, WORKING HOURS, AND LIMITS OF CLEARING SHALL BE FLAGGED BY CONTRACTOR PRIOR TO CONSTRUCTION AND APPROVED BY PROJECT ENGINEER. 13. THE CONTRACTOR SHALL MAINTAIN ALL ROADWAYS, SIDEWALKS, AND WALKWAYS IN THE AREA FREE OF SOIL, MUD,
- AND CONSTRUCTION DEBRIS. CONSTRUCTION ENTRANCES MUST BE MAINTAINED AT EACH SITE ACCESS POINT. SEE PLANS AND DETAILS. 14. ALL AREAS SURROUNDING THE PROJECT SITE DISTURBED DURING CONSTRUCTION SHALL BE RESTORED UPON
- COMPLETION OF CONSTRUCTION. THE RESTORATION OF THE SITE IS SUBJECT TO APPROVAL BY THE TOWN AND THE PROJECT ENGINEER.
- 15. FOLLOWING COMPLETION OF CONSTRUCTION, THE CONTRACTOR SHALL PARTICIPATE IN A FINAL SITE INSPECTION WITH THE LANDOWNER, TOWN AND PROJECT ENGINEER FOR THE PURPOSE OF VERIFYING THAT THE PROJECT HAS BEEN COMPLETED ACCORDING TO THE CONSTRUCTION PLANS, SPECIFICATIONS AND THE TERMS AND CONDITIONS OF THE CONTRACT.

OPERATION AND MAINTENANCE NOTES:

- ANNUALLY AND AFTER LARGE STORMS VISIT SITE TO ASSESS SITE CONDITION AND MAINTENANCE NEEDS. 2. REMOVE LEAVES AND DEBRIS ACCUMULATED AT STORMWATER PIPE OUTLETS AND WITHIN THE OVERFLOW WEIR FROM THE HEALTH CENTER STORMWATER POND.
- 3. THE ACCUMULATION OF SEDIMENT IN THE STORMWATER SETTLING BASINS SHOULD BE MONITORED AND INSPECTED A MINIMUM OF ONCE ANNUALLY AND SEDIMENT IN THE STORMWATER SETTLING BASINS SHOULD BE REMOVED WHEN 1 FOOT OF SEDIMENT HAS BEEN ACCUMULATED.
- 4. RESEEDING WITH SPECIFIED SEED MIX SHOULD REOCCUR AFTER REMOVAL OF SEDIMENT AND RESHAPING OF BASINS. 5. MONITOR STORMWATER SETTLING BASINS, BERMS, AND SWALE FOR EXCESSIVE EROSION OR DISPLACEMENT OF
- STONE AND REPAIR AS NEEDED. 6. DURING FIRST YEAR OF OPERATION, WATERING, REPLACEMENT OF DEAD PLANTS, AND REMOVAL OF INVASIVE SPECIES IS IMPORTANT FOR ESTABLISHMENT.







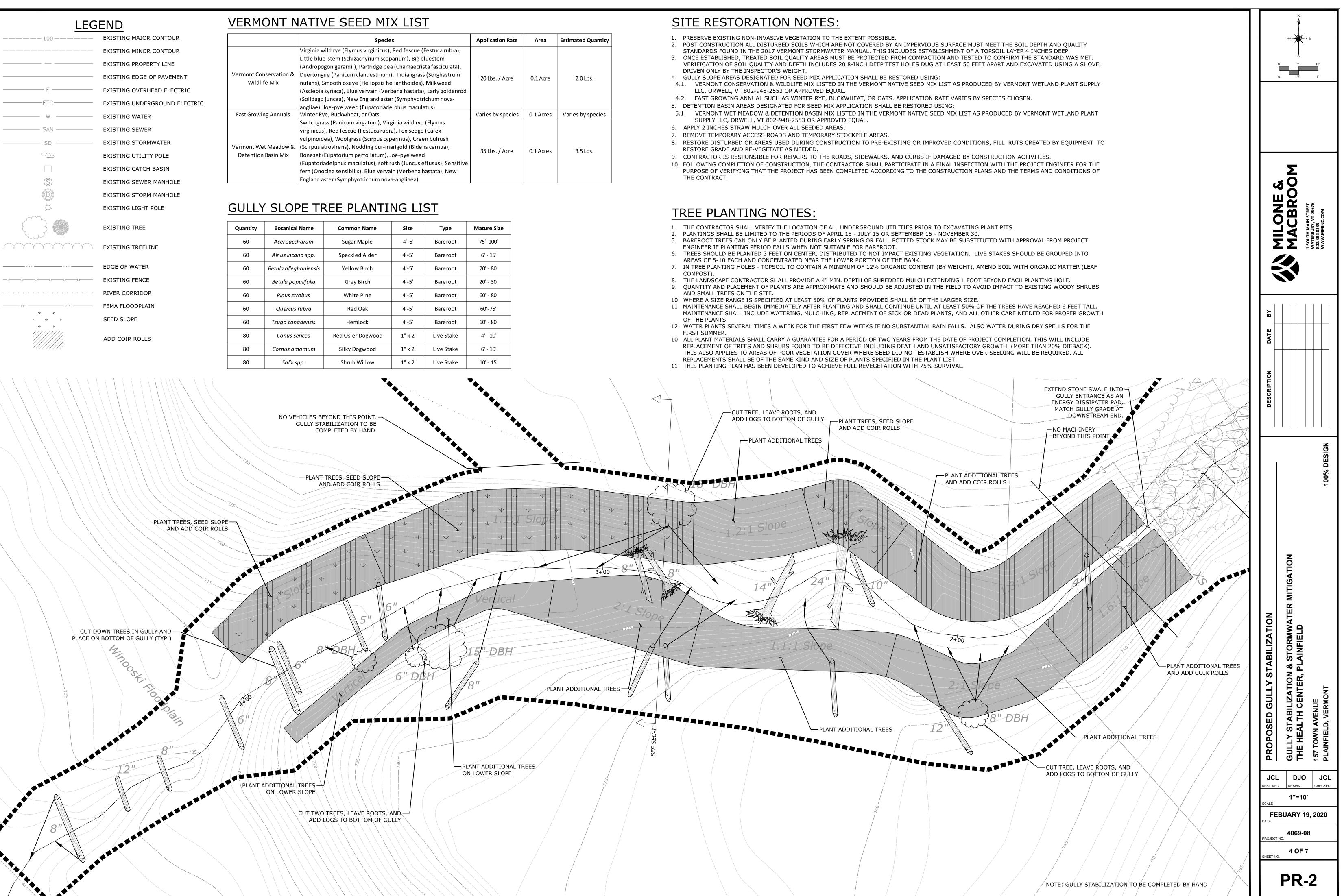
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WATER FENCE

	Species	Application Rate	Area	Estimated Quantity	
Vermont Conservation & Wildlife Mix	Virginia wild rye (Elymus virginicus), Red fescue (Festuca rubra), Little blue-stem (Schizachyrium scoparium), Big bluestem (Andropogon gerardii), Partridge pea (Chamaecrista fasciculata), Deertongue (Panicum clandestinum), Indiangrass (Sorghastrum nutans), Smooth oxeye (Heliopsis helianthoides), Milkweed (Asclepia syriaca), Blue vervain (Verbena hastata), Early goldenrod (Solidago juncea), New England aster (Symphyotrichum nova- angliae), Joe-pye weed (Eupatoriadelphus maculatus)	20 Lbs. / Acre	0.1 Acre	2.0 Lbs.	
Fast Growing Annuals	Winter Rye, Buckwheat, or Oats	Varies by species	0.1 Acres	Varies by species	
Fast Growing AnnualsWinter Rye, Buckwheat, or OatsFast Growing AnnualsWinter Rye, Buckwheat, or OatsSwitchgrass (Panicum virgatum), Virginia wild rye (Elymus virginicus), Red fescue (Festuca rubra), Fox sedge (Carex vulpinoidea), Woolgrass (Scirpus cyperinus), Green bulrush (Scirpus atrovirens), Nodding bur-marigold (Bidens cernua), Boneset (Eupatorium perfoliatum), Joe-pye weed (Eupatoriadelphus maculatus), soft rush (Juncus effusus), Sensitive fern (Onoclea sensibilis), Blue vervain (Verbena hastata), New England aster (Symphyotrichum nova-angliaea)		35 Lbs. / Acre	0.1 Acres	3.5 Lbs.	

Quantity	Botanical Name	Common Name	Size	Туре	Mature Size
60	Acer saccharum	Sugar Maple	4'-5'	Bareroot	75'-100'
60	Alnus incana spp.	Speckled Alder	4'-5'	Bareroot	6' - 15'
60	Betula alleghaniensis	Yellow Birch	4'-5'	Bareroot	70' - 80'
60	Betula populifolia	Grey Birch	4'-5'	Bareroot	20' - 30'
60	Pinus strobus	White Pine	4'-5'	Bareroot	60' - 80'
60	Quercus rubra	Red Oak	4'-5'	Bareroot	60'-75'
60	Tsuga canadensis	Hemlock	4'-5'	Bareroot	60' - 80'
80	Conus sericea	Red Osier Dogwood	1" x 2'	Live Stake	4' - 10'
80	Cornus amomum	Silky Dogwood	1" x 2'	Live Stake	6' - 10'
80	Salix spp.	Shrub Willow	1" x 2'	Live Stake	10' - 15'



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- ING MAJOR CONTOUR ING MINOR CONTOUR ING PROPERTY LINE ING EDGE OF PAVEMENT ING OVERHEAD ELECTRIC ING UNDERGROUND ELECTRIC ING WATER ING SEWER ING STORMWATER ING UTILITY POLE ING CATCH BASIN ING SEWER MANHOLE ING STORM MANHOLE ING LIGHT POLE ING TREE ING TREELINE
- EDGE OF WATER
- EXISTING FENCE
- RIVER CORRIDOR
- FEMA FLOODPLAIN SEDIMENT FILTER FENCE
- TEMPORARY CONSTRUCTION ENTRANCE

TEMPORARY CONSTRUCTION ACCESS ROUTE

SEDIMENT AND EROSION CONTROL NOTES:

- 1. THE SEDIMENT AND EROSION CONTROL PRACTICES IMPLEMENTED AS PART OF THE PROJECT SHALL BE IMPLEMENTED AND MAINTAINED ACCORDING TO "THE LOW RISK SITE HANDBOOK FOR EROSION PROTECTION AND SEDIMENT CONTROL" GUIDANCE DOCUMENT FROM THE VERMONT DEPARTMENT OF ENVIRONMENTAL CONSERVATION, WHERE APPLICABLE IN CONSULTATION WITH PROJECT ENGINEER.
- 2. A COPY OF THE APPROVED EROSION AND SEDIMENT CONTROL PLAN SHALL BE MAINTAINED ON THE SITE AT ALL TIMES.
- CLEARING OF VEGETATION FOR CONSTRUCTION ACCESS SHOULD BE MINIMIZED.
 THE CONTRACTOR IS RESPONSIBLE FOR THE MAINTENANCE OF ALL SOIL EROSION AND SEDIMENT CONTROL MEASURES. THE CONTRACTOR WILL VERIFY THE MAINTENANCE WEEKLY AND AFTER RAIN EVENTS AND REPORT TO THE PROJECT ENGINEER.
- THE PROJECT ENGINEER IS TO BE NOTIFIED IMMEDIATELY IF EXCESSIVE SEDIMENT EROSION TAKES PLACE, IF SIGNIFICANT FINE GRAIN SEDIMENT IS ENCOUNTERED OR IF POTENTIALLY CONTAMINATED SEDIMENTS ARE ENCOUNTERED (OILY, DARK COLOR, CHEMICAL ODOR).
 PLAN AND PERFORM WORK DURING LOW FLOW PERIODS.
- WORK SHALL PROGRESS IN STAGES TO MINIMIZE EXPOSED AREAS AND DISTURBED EARTH. NO MORE THAN TWO (2) ACRES OF DISTURBED EARTH WILL BE ALLOWED AT ANY ONE TIME.
- 8. NO DISTURBED EARTH SHALL REMAIN EXPOSED FOR MORE THAN SEVEN (7) CONSECUTIVE DAYS WITHOUT APPLYING TEMPORARY OR PERMANENT STABILIZATION MEASURES.
- EXPOSED AREAS SHALL BE SEEDED AND MULCHED OR PROTECTED WITH EROSION CONTROL MATTING WITHIN 48 HOURS OF ACHIEVING FINAL GRADE.
 STOCKPILE AREAS TO BE ENCLOSED BY SILT FENCING.
- STOCKPILE AREAS TO BE ENCLOSED BY SILT FENCING.
 THE SITE SHOULD BE KEPT CLEAN OF LOOSE DEBRIS, LITTLER, AND OTHER MATERIAL SUCH THAT NONE OF THESE MATERIAL ENTER WATERS OR WETLANDS.

CONSTRUCTION SEQUENCE NOTES:

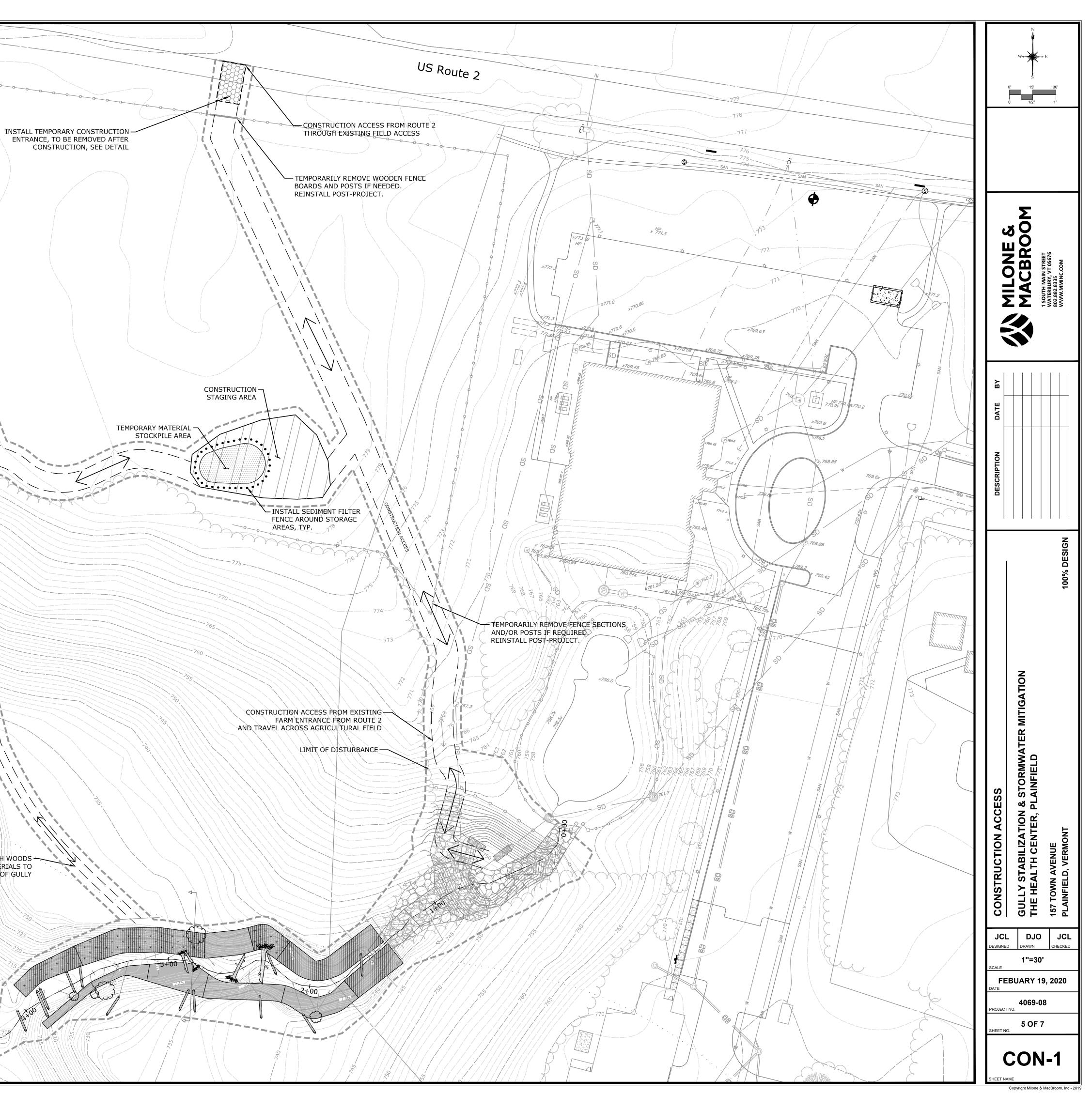
THIS PROPOSED SEQUENCE OF CONSTRUCTION IS PROVIDED FOR GENERAL INFORMATION ONLY. SEE PLANS FOR ADDITIONAL NOTES. THE OVERALL SEQUENCE OF CONSTRUCTION IS TO BE DETERMINED AND SUBMITTED BY THE CONTRACTOR AND APPROVED BY THE PROJECT ENGINEER.

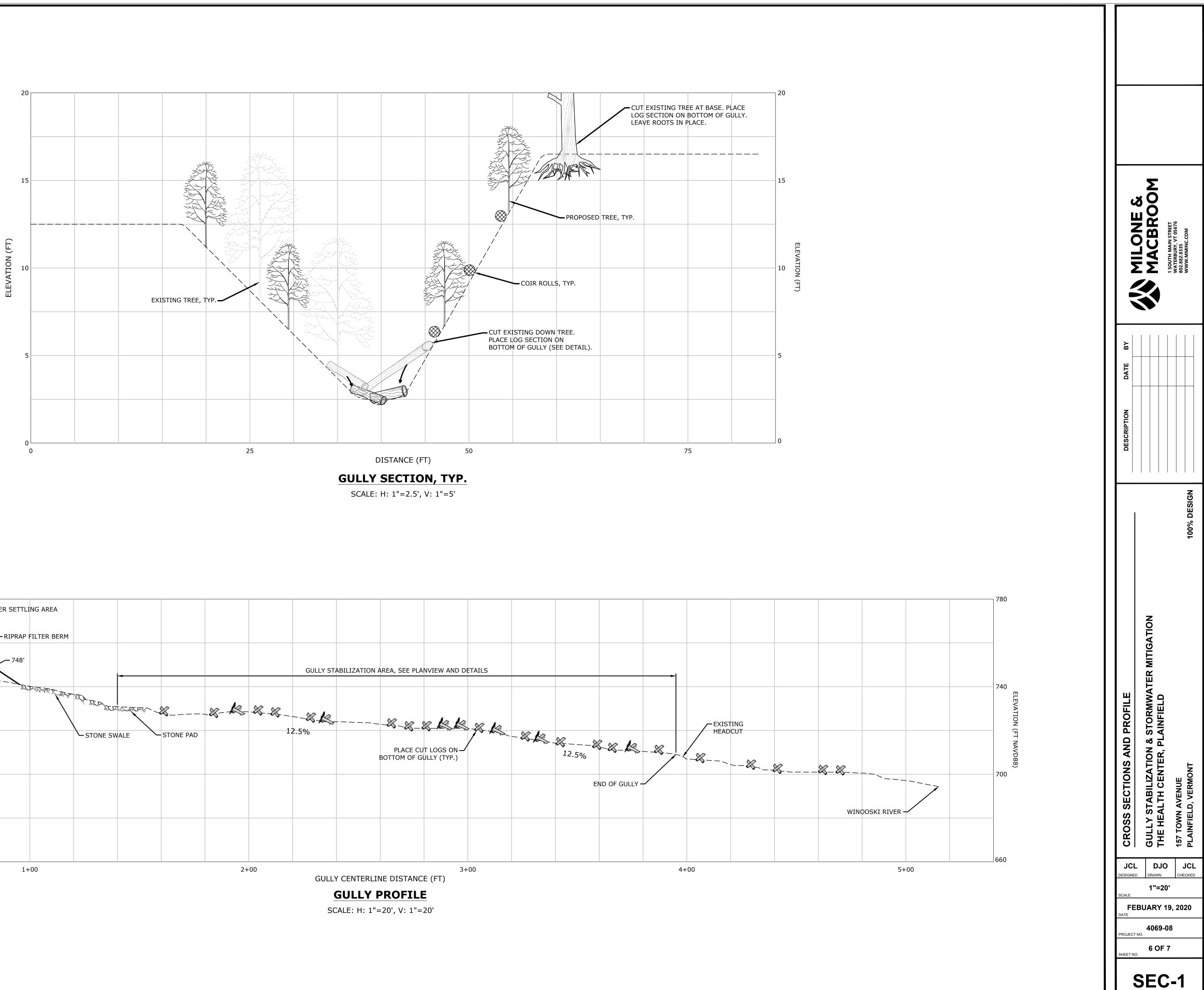
- 1. OBTAIN ANY NECESSARY WORK PERMITS AND SUBMIT SCHEDULES, PLANS AND PRODUCT INFORMATION, INCLUDING THE SEDIMENT AND EROSION CONTROL PLAN, CONSTRUCTION SEQUENCE, WATER CONTROL PLAN AND EMERGENCY OPERATION PLAN TO THE PROJECT ENGINEER FOR REVIEW SEVEN (7) DAYS PRIOR TO INITIATION OF CONSTRUCTION. INSTALL CONSTRUCTION WARNING SIGNS.
- 2. CONTRACTOR SHALL PARTICIPATE IN A PRE-CONSTRUCTION SITE MEETING WITH THE PROJECT ENGINEER, TOWN, AND OTHERS TO REVIEW PERMIT REQUIREMENTS, CONTRACT PROVISIONS AND SPECIFICATIONS, PROJECT LIMITS AND CONSTRUCTION DETAILS.
- STAKE OUT LIMITS OF WORK AND INSTALL SEDIMENT AND EROSION CONTROLS AND SAFETY FENCING.
 ESTABLISH CONSTRUCTION SITE ACCESS INCLUDING TEMPORARY IMPROVEMENTS AS
- ESTABLISH CONSTRUCTION SITE ACCESS INCLUDING TEMPORARY IMPROVEMENTS AS NEEDED.
 STAKE OUT PROJECT FEATURES SO THAT ALL WORK DURING CONSTRUCTION WILL MOVE
- STAKE OUT PROJECT FEATORES SO THAT ALL WORK DURING CONSTRUCTION WILL MOVE TOWARDS THE DESIRED DIMENSIONS AS SHOWN ON THE PLANS. CONSTRUCTION LAYOUT TO BE APPROVED BY THE PROJECT ENGINEER.
 PERFORM GULLY STABILIZATION WORK INCLUDING CUTTING AND PLACING TREES,
- FERIORM GOLLT STABILIZATION WORK INCLODING COTTING AND FLACING TREES, INSTALLING COIR ROLLS, PLANTING TREES, AND SEEDING SLOPES.
 STOCKPILE EXISTING RIPRAP AND EXCAVATE AREA OF PROPOSED STORMWATER AREA.
- STOCKFILL EXISTING RIFKAF AND EXCAVATE AREA OF PROPOSED STORMWATER AREA.
 CUT AND MODIFY STORMWATER PIPES TO DISCHARGE INTO PROPOSED STORMWATER AREA.
- INSTALL RIPRAP BERMS BETWEEN STORMWATER AREA.
 SEED STORMWATER AREA.
- 11. RESTORE REMAINDER OF SITE INCLUDING TEMPORARY CONSTRUCTION ACCESS, STOCKPILE AREAS, STAGING AREAS, AND ANY ADDITIONAL AREAS DISTURBED DURING CONSTRUCTION TO ORIGINAL OR IMPROVED CONDITION.
- 12. PARTICIPATE IN A FINAL SITE INSPECTION.

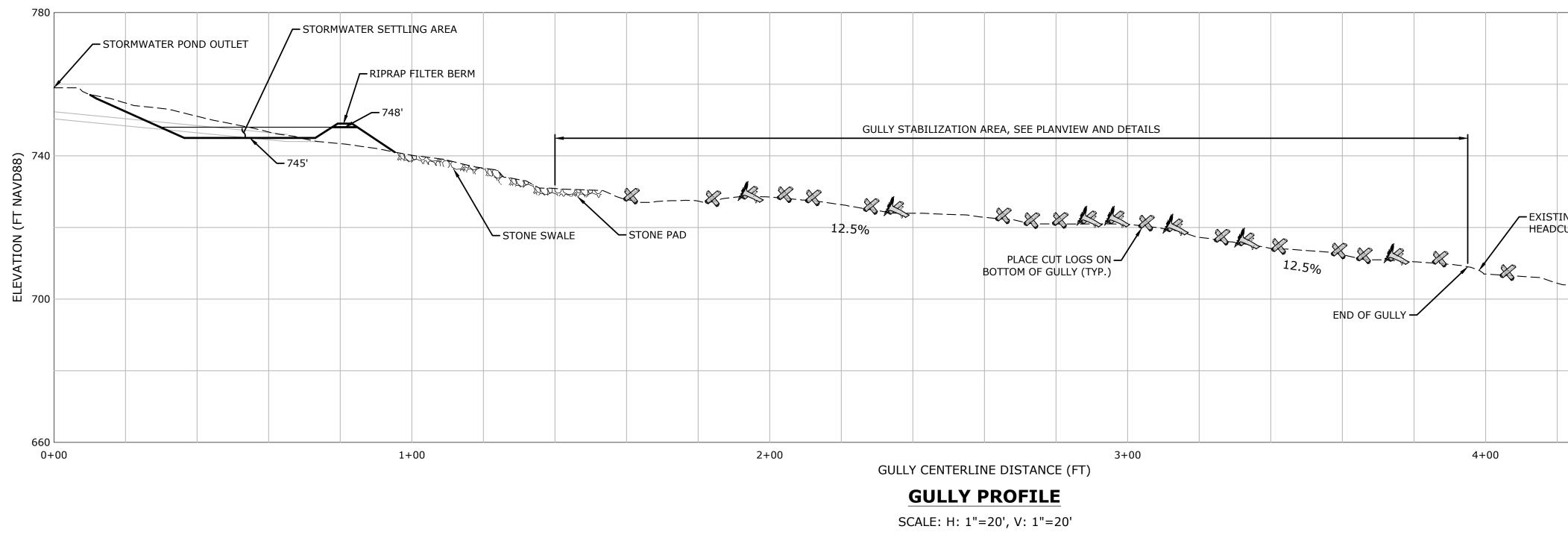
OFF-ROAD ACCESS THROUGH WOODS FOR DELIVERY OF MATERIALS TO LOWER PORTION OF GULLY

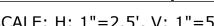
ACCESS ALONG EXISTING -

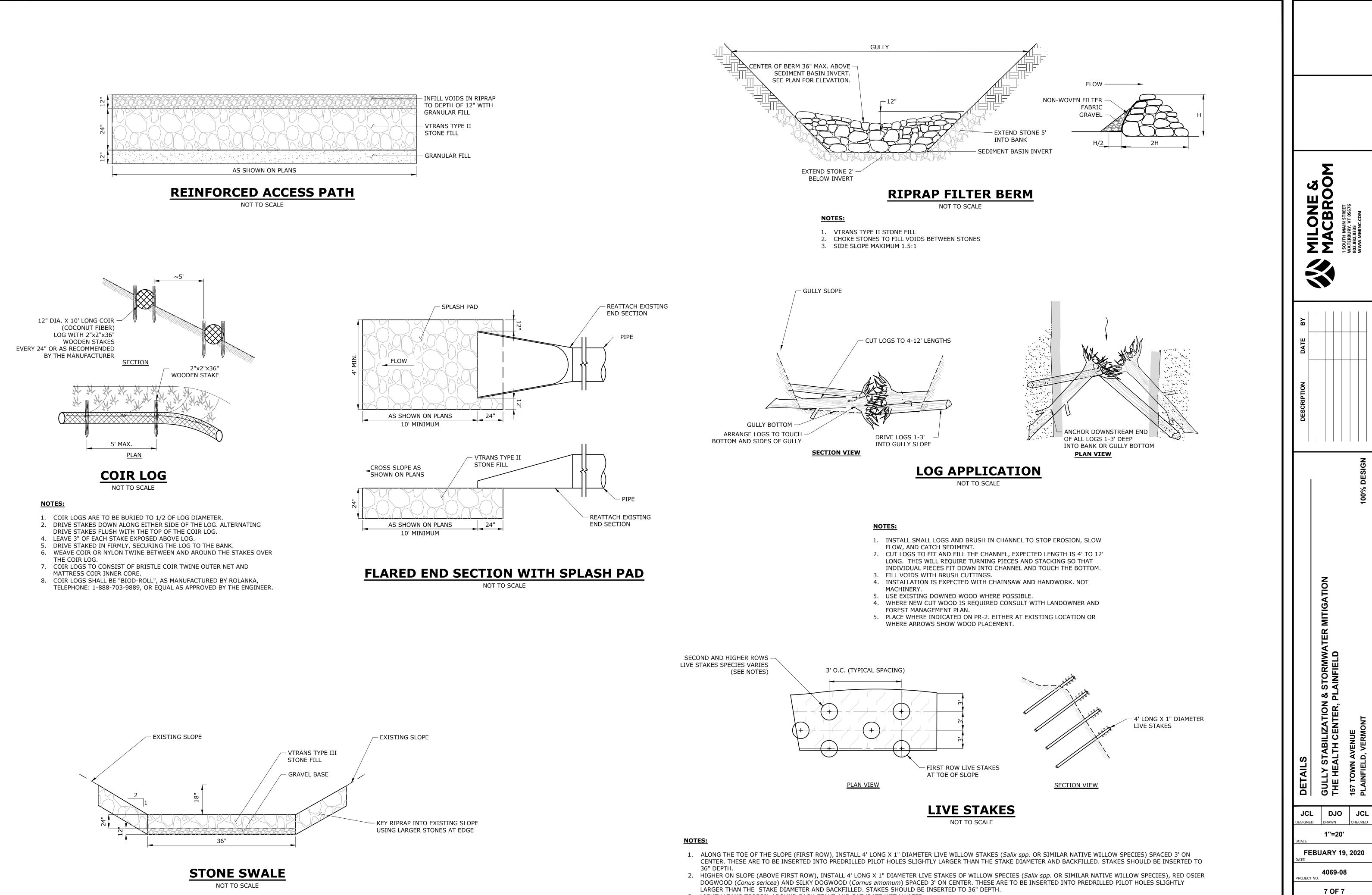
FARM PATH

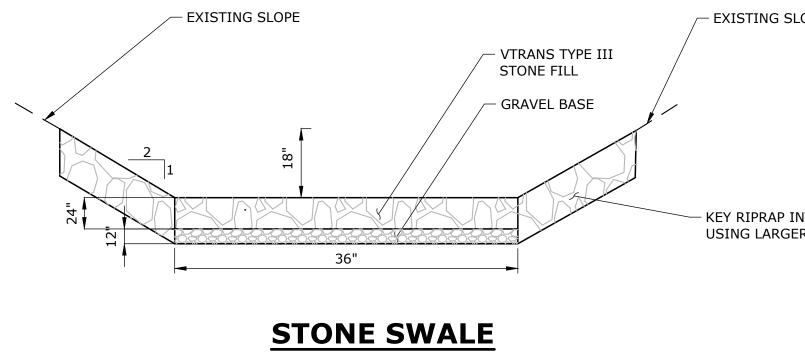












- 3. LIGHTLY TAMP TOPSOIL AROUND EACH STAKE AND SATURATE WITH WATER. SITE UNDER A WET TARP TO PROTECT THEM FROM WIND, DIRECT SUNLIGHT, DRYING OR OTHER DAMAGE. CUTTINGS OR UNROOTED STOCK THAT IS NOT PLANTED
- 5. WILLOW SPECIES AND SOURCES SHALL BE APPROVED BY THE ENGINEER PRIOR TO INSTALLATION.

4. PLANT MATERIALS SHOULD BE PLANTED THE DAY THEY ARRIVE ON SITE. PLANTS AND CUTTINGS THAT CANNOT BE PLANTED THE DAY THEY ARRIVE SHALL BE STORED ON WITHIN TWO DAYS AFTER ARRIVAL ON THE SITE SHALL BE DISCARDED UNLESS REFRIGERATED AT 40 TO 50 DEGREES FAHRENHEIT.

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APPENDIX D FINAL (100%) DESIGN COST OPINION



OPINION OF PROBABLE COSTS

GULLY STABILIZATION & STORMWATER MITIGATION

THE HEALTH CENTER, PLAINFIELD

PLAINFIELD, VERMONT

January 31, 2020 MMI# 4069-08





Description	Unit	Quantity	Unit Price (\$)	ŀ	Amount (\$)
CONSTRUCTION SETUP					
MOBILIZATION	LS	1	10,000		10,000
SITE PREPARATION AND ACCESS	LS	1	10,000		10,000
CONSTRUCTION EROSION CONTROLS	LS	1	10,000		10,000
STORMWATER AREA WORK					
EXCAVATION AND HAUL FILL	CY	350	25		8,750
EXCAVATION BASIN SHAPING	LS	1	5,000		5,000
FURNISH AND INSTALL RIPRAP BERMS	CY	200	60		12,000
FURNISH AND INSTALL RIPRAP SWALES, PADS, AND PATH	CY	200	60		12,000
PIPE MODIFICATIONS	LS	1	5,000		5,000
FURNISH AND INSTALL FENCING	LF	120	35		4,200
FURNISH AND INSTALL GATE	EA	1	1,000		1,000
GULLY WORK					
REMOVE INVASIVE SPECIES	LS	1	5,000		5,000
CUT AND PLACE DOWN AND LIVE TREES	EA	30	500		15,000
SEED AND MULCH	EA	1	3,000		3,000
FURNISH AND INSTALL COIR LOGS	LF	800	20		16,000
FURNISH SMALL TREES	EA	420	20		8,400
FURNISH LIVE STAKES	EA	240	6		1,440
PLANTING LABOR	LS	1	15,000		15,000
SITE RESTORATION AND DEMOBILIZATION	LS	1	10,000		10,000
SUBTOTAL (ROUNDED)				\$	152,000
PERMITTING				\$	9,000
BID PHASE SERVICES				\$	6,000
CONSTRUCTION OVERSIGHT (PART TIME)				\$	20,000
CONSTRUCTION CONTINGENCY (15%)				\$	22,800
TOTAL (ROUNDED)				\$	210,000





Simple Method Pollutant Loading Calculation Worksheet- Sediment

The Simple Method estimates pollutant loading of stormwater runoff for urban and developed areas. This worksheet includes the data and calculations to be used for computation of existing and post-development loads under the <u>Interim Procedure for Offsets for Discharges of Phosphorus to Lake Champlain and Waters that</u> <u>Contribute to the Impairment of Lake Champlain</u>. Fill in the shaded fields bas ed on the project site attributes.

L = 0.226* P * P_j * R_v *A* C Additional information on the Simple Method can be found on the 'Guidance' tab

Where:

- L = Annual load (lbs)
- P = Yearly rainfall depth (in)

P_j = Fraction of rainfall events producing runoff (use 0.9)

A = Site area (acres)

C = Average annual pollutant concentration (mg/l), see 'Guidance'

0.226 = Unit conversion factor

Offset Calculations			
Stormwater Mitigation at The			
Project Name:	Health Center, Plainfield		
C-Values* from:	NH DES		
Pj	0.9		
Project P [*] 40.9			
*http://www.ncdc.noaa.gov/cdo-web/datatools/normals			

Load (lbs) Pre-Development Land Cover type Site Area (ac) Imp. Area (ac) l_a (%) R, C (mg/L)* Rural Open / Forest 20.52 0 0 0.05 51 435.30 10.54 635.70 Ag/Pasture 0 0 0.05 145 **Existing Conditions** Impervious/ Driveway 5.32 100 173 7273.70 5.32 0.95 0 0.05 0.00 Pre-Dev. Total 8344.71

Post-Development	Land Cover	Site Area (ac)	Imp. Area (ac)	l _a (%)	R _v	C (mg/L)	Load (lbs)
	Rural Open / Forest	20.52	0	0	0.05	51	435.30
	Ag/ Pasture	10.54	0	0	0.05	145	635.70
	Impervious/ Driveway	5.32	5.32	100	0.95	173	7273.70
				0	0.05		0.00
	Post-Dev. Total						8344.71
	Load reduction from treatment (%) (see guidance!)						79
	Post-dev. load after treatment is provided						1,752.39
Sediment Volume Calculation:							
andard weight of sediment =	: 2,000 lb / CY						
8345 lb sediment = ~		4.2	CY / year = ~				

And:

Rv = 0.05 + 0.009 * I_a

Where:

R_v = Runoff Coefficient

 I_a = Whole number percent impervious

Plainfield, VT 1/30/2020 lookup date