Manalapan Brook (WMA#9)- Stream Visual Assessment Scoring Sheet

Stream ID # _____ Downstream: ____ Upstream: _____

Road Crossing: _____ Stream Name: _____

Town: _____ County: Middlesex / Monmouth

Survey Team: C Altomari (PH) Tara Petti (NJWSA)

Date: _____ Weather: _____

Channel Width:_____ Depth:_____ Water Appearance:_____

Dominant Substrate: ___ cobble ___ gravel ____ sand ___ silt ____ clay ___ mud

GPS Latitute:_____Longitude:_____

Assessment Scores

Vegetated Buffer Width	RB LB	10 Width of buffer zone >50ft; no impacts (parking lots, roads, clear-cuts, lawns, crops) 7 Width of buffer zone 25-50 ft.; human activity impacts 3 Width of buffer zone 10-25 feet 1 Width of buffer zone <10 feet
Vegetated Buffer Condition	RB LB	10 3 habitat layers present. Low invasive plants. 7 One habitat layer impaired. Scattered invasive plants. 3 Two habitat layers impaired. Invasive species dominant. 1 Two or more habitat layers missing. Low diversity. Invasive species dominant Severely degraded.
Canopy Cover		10 > 75% of water shaded and upstream well shaded 7 > 50% shaded in reach, or upstream poorly shaded 3 20-50% of water surface in reach is shaded 1 < 20% of water surface in reach shaded
Bank Stability		10 Banks are stable; at elevation of active flood plain 7 Moderately stable; at elevation of active flood plain; < 33% bends eroding, protected by roots at baseflow. 5 Moderately unstable; outside bends are actively eroding (Overhanging vegetation, falling trees, some slope failure) 1 Unstable; some straight reaches, inside and outside bends are eroding, falling trees, numerous slope failures)
Channel Condition		10 Natural channel; no structures, no channelization of stream 7 Recovery of past channel alteration, access to floodplain 3 Altered channel <50% of reach with riprap, Channelization, mid-channel gravel bars, braided channel. Stream is actively down cutting or widening. 1 >50% of reach is altered, rip rapped, channelized or gravel bars. Access to floodplain is restricted
Hydrologic Alterations		10 No evidence of hydrologic alterations (dams, channels or ditches) 7 Minor hydrologic alterations. Withdrawals not affecting habitat 3 Moderate hydrologic alterations. Withdrawals significantly affect available low flow habitat for biota. 1 Significant hydrologic alterations. Withdrawals have caused severe loss of low flow habitat.
Floodplain Encroachment (Don't add to score)		10 No evidence of floodplain encroachment or manmade structures 7 Minor floodplain encroachment: fill materials, development, or manmade structures, but not effecting floodplain function. 3 Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some affect on floodplain 1 Significant floodplain encroachment (i.e., fill, development or manmade structures). Significant effect on floodplain function.
Aquatic Plant Community		10 Clear water along entire reach: diverse aquatic plant community; little algal growth present. 7 Fairly clear or slightly greenish water along entire reach; moderate algal growth on stream substrates. 3 Greenish water along entire reach; over abundance of algal, macrophytes 1 Pea green, gray, or brown water along entire reach; dense stands of macrophytes clog stream; severe algal blooms & mats

Invertebrate Habitat: fine woody debris, submerged logs, leaf packs, undercut banks, cobble, boulders, coarse gravel		10 5 types of habitat available, full insect colonization 7 3 to 4 types of habitat, such as overhanging trees, 3 1 to 2 types of habitat, substrate is disturbed, covered, or scoured 1 None to 1 type of habitat.
Instream Fish Cover: logs/large woody debris, deep pools, over hanging vegetation, boulders/cobble, riffles, undercut banks, thick root mats, dense macrophyte beds, isolated/backwater pools		10 >7 cover types available 8 6 to 7 cover types available 5 4 to 5 cover types available 3 2 to 3 cover types available 1 0 to 1 cover type available
Barriers to Fish Movement:		10 No Barriers 7 Drop structures, culverts or diversions (<1' drop) within reach 3 Drop structures, culverts, or diversions (> 1' drop) within 3 miles 1 Drop structures, culverts, or diversions (> 3' drop) within reach
Velocity / Depth Variability		10 All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, and fast-shallow) 7 Only 3 of the 4 regimes present 3 Only 2 of the 4 habitat regimes present 1 Dominated by 1 velocity/depth regime (usually slow-deep)
Pool Variability		10 Mix of large-shallow, large deep, small shallow, small-deep pools 7 Majority of pools large-deep; very few shallow 3 Shallow pools much more prevalent than deep pools 1 Majority of pools small-shallow or pools absent
Manure Present		5 Evidence of livestock access to riparian zone. 3 Occasional manure or waste storage located in floodplain. 1 Extensive amount of manure on banks/stream Or Untreated human waste discharge pipes present

Total Points		**Scoring scheme TBD based on results**
Number of Categories Scored		
OVERALL SCORE (Divide Total Points by Number of Categories Scored)		

Wildlife: _____

Notes on Reach (biggest problem(s): _____

_____

_____

_____

_____

_____

Streamside Land Use (NJ): (1. Present 2. Clearly impacting the stream)

Type of Use	Within 100' of stream	*As interpreted from aerial photos*	*If significant impact evident, GPS Coordinates/ Description of Location and take photos*
Agricultural grazing land			
Agricultural cropland (soy, hay, corn)			
Agricultural feed lots/animal holding areas			
Inactive agricultural land/fields			
Residential single-family housing			
Residential multifamily housing			
Industrial			
Commercial/Institutional			
Residential Lawns			
Waterfowl (w/approx number)			
Recreational hiking/paths			
Horse trails			
Paved Roads			
Unpaved Roads			
Road drainage impacts			
Timbering/woodland management			
Construction Underway for:			*Note if 100 ft or 150 ft buffer is being protected. If not, take pictures and contact Soil Conservation Service.*
Housing development			
Commercial			
Road/bridge construction repair			
Utility impacts/crossings (gas pipelines, electrical lines)			
ATV and recreational vehicle crossings/damage			
Other:			

Manalapan Lake Watershed Restoration/Implementation Project - Outfall Survey

(based on NJDEP VAP)

Subwatershed #: _____ Town: _____ WRPOS #: _____

Date (mm/dd/yy): _____ Land is: Public/Private/Easement _____

Stream Name/ ID: _____ Reach No: _____

OUTFALL PIPE

Number of Pipes within Reach: _____

Location Description: _____

Outfall Pipe Reference # _____ Pipe Diameter: _____(in/ft)

Outfall Type #: _____ 1. Unknown 2. Residential discharge 3. Industrial Discharge (NJPDES # _____) 4. Combined sewer overflow 5. Storm Drain 6 Settlement Basin/Stormwater Detention Pond (Wet) 7 Settlement Basin/Stormwater Detention Pond (Dry) 8 Other

Origination Point (if able to follow ditch to origin): _____

Pipe Material: _____ 1. Concrete 2. Steel 3. PVC 4. Clay 5. Other _____

GPS Coord. of Pipe at Stream: Lat _____ _____'_____" Long_____ _____'_____"

Pipe Location: _____1. In stream 2. In stream bank 3. Near stream

Pipe Flow/Appearance: _____ 1. None 2. Trickle 3. Intermittent 4. Steady 5. Heavy

Flow Color**: _____**

Stream channel downstream: _____ 1. Stable 2. Eroded

Pipe Conditions (circle #):

Heavy discharge with a distinct color and/or a strong smell. The amount of discharge is significant compared to the amt of normal flow in receiving stream; discharge appears to be having a significant impact downstream.		Small discharge; flow mostly clear and odorless. If the discharge has a color and/or odor, the amt of discharge is very small compared to the stream's baseflow and any impact appears minor/localized.		Pipe does not have dry weather discharge; staining; or appearance of causing any erosion problems
5	**4**	**3**	**2**	**1**

Photos Taken (record on photo log): **Yes No**

Observations: (indicate locations on map):

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Manalapan Lake Watershed Restoration/Implementation Project - Drainage Ditch Survey

(based on NJDEP VAP)

Subwatershed #: _____ Town: _____ WRPOS #: _____

Date (mm/dd/yy): _____ Land is: Public/Private/Easement _____

Stream Name/ ID: _____ Reach No: _____

DRAINAGE DITCH

Number of Ditches within Reach: _____

Location Description: _____

Drainage Ditch Reference Number: _____

Drainage Ditch Source # _____ 1. Unknown 2. Road drainage 3. Parking Lot 4. Agricultural field 5. Livestock Operation 6. Settlement Basin/Stormwater Detention Pond (Wet) 7 Settlement Basin/Stormwater Detention Pond (Dry)

GPS Coordinates of Ditch at Stream: Lat N_____° _____'_____" Long W _____° _____'_____"

Ditch Lining: _____1. Stone 2. Vegetation 3. Concrete

Ditch Is: _____1. Stable 2. Eroding

Ditch Flow: _____1. None 2. Intermittent 3. Steady

Flow Appearance: _____1. Clear 2. Turbid 3. Oily 4. Foamy 5. Colored _____

Stream channel downstream: _____ 1. Stable 2. Eroded

Ditch Conditions (circle #):

Heavy discharge with a distinct color and/or a strong smell. The amount of discharge is significant compared to the amt of normal flow in receiving stream; discharge appears to be having a significant impact downstream.		Small discharge; flow mostly clear and odorless. If the discharge has a color and/or odor, the amt of discharge is very small compared to the stream's baseflow and any impact appears minor/localized.		Ditch does not have dry weather discharge; staining; or appearance of causing any erosion problems
5	**4**	**3**	**2**	**1**

Photos Taken (record info on photo log)? Yes No

Observations: (indicate locations on map):

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Subwatershed #: _____ **Town:** _____ **WRPOS #:** _____

Date (mm/dd/yy): _____**Time:** _____ **Land is: Public/ Private/Easement**

Stream Name/ ID: _____ **Reach No:** _____

Invasive Plant Survey:

Are there invasive plant species present along the stream reach?

Yes; No Comments: _____

_____

_____

If invasive plant species are present, specify type and extent of colonization throughout reach below:

Invasive Plant	**Extent Of Damage** *L-local, S-scattered, W-widespread*
Multiflora rose (S) (*Rosa multiflora*)	
Japanese honeysuckles (*Lonicera*) (V/S)	
Oriental bittersweet (V) (*Celastrus orbiculatus*)	
Purple loosestrife (H) (*Lythrum salicaria*)	
Winged burning bush (S) (*Euonymus alata*)	
Norway maple (T) (*Acer platanoides)*	
This is not a comprehensive list of invasive plants. Refer to the NPS Handbook for other invaders. S= shrub; V= vine; H= herbaceous; T= tree	

Invasive Plant	**Extent Of Damage** *L-local, S-scattered, W-widespread*
English Ivy (V) *(Hedera helix)*	
Common reed (H) (*Phragmites australis*)	
Japanese knotweed (H) (*Polygonum cuspidatum*)	
Autumn olive (S) (*Elaeagnus umbellata*)	
Garlic mustard (H) *(Alliaria petiolata)*	
Others:	

Comments:

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Manalapan Brook – Part I
Visual Assessment Tour #100-40

April-May 2008

VA Station #86 Private Pond
Manalapan Township

Christine Altomari
Princeton Hydro
908-237-5660
www.princetonhydro.com

Assisted by:
NJWSA, Tara Petti
NJDEP Watershed Ambassador, Kristyn Morrison
Princeton Hydro, Mary Lambert

Millstone Twp VA# 99-100

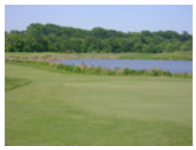
- Headwater lands of the Manalapan Brook are developed with large housing developments. But the headwater tributaries, floodplain and main stem of the Brook remain as intact forest and wetlands.
- Much of these private riparian lands were not accessible.
- Ensure that conservation easements are recorded, and signs posted to ensure the long term integrity of these undeveloped riparian areas.

Millstone Twp VA#98
Main Stem

- Remove sediment bar blocking one culvert upstream; large spreading cattail patch upstream
- ID sediment source and mitigate
- Plant trees to mitigate limited stream bank erosion (1-2ft) downstream

Millstone Twp VA# 92
Charleston Springs Golf Course Pond
MB Main Stem

Millstone Twp VA# 94, 95, 96
Charleston Springs Golf Course Pond



Millstone Twp VA# 92
Charleston Springs Golf Course Pond

Reduce NPS and sediment loadings, eradicate spread of pond lilies, maintain dam, dredge sediments from pond channel.

Millstone Twp VA# 92
Charleston Springs Golf Course Pond

1995 farm & nursery prior to 1997 construction – lilies not present

Millstone Twp VA# 92
Charleston Springs Golf Course Pond

2002 lilies present upstream of bridge

2005 lilies spreading up and downstream of bridge- possible nutrient & sediment loading

Sources: NJDEP GIS and Google maps

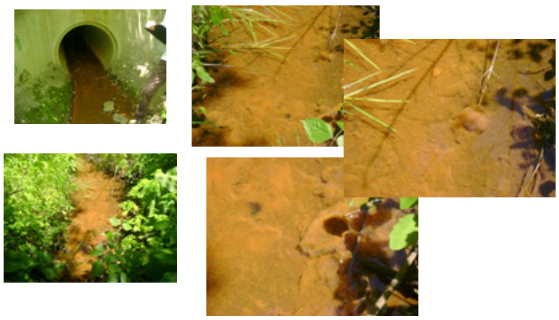
Manalapan Twp VA #91
Main Stem

Manalapan Twp VA# 91
Pond & Basin Maintenance

Manalapan Twp VA # 90
Randall Dr- SW Basin Maintenance

Manalapan Twp – VA #89
Iron staining and floc

Manalapan Twp – VA 88
Iron staining, floc and bacteria

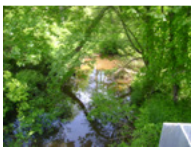


Manalapan Twp VA# 87, 86

 # 87 tributary algae present

#86 large private pond, mowed buffer, large geese presence, swans & domestic ducks present. Encourage no mow, buffer plantings, and no feeding signs.

Manalapan Brook VA #85
Main Stem



Manalapan Twp – VA # 84
Tributary Channeled in Basin

Tributary flows into basin down low flow concrete channel. Impacts include sediment deposition, no shade, limited habitat, high water temperatures & excessive algal growth.

Manalapan Twp – VA # 84
Tributary Channeled in Basin

Divert tributary into natural channel within the basin. Add shade trees and plantings. Modify the outlet structure to retain SW.

Downstream of basin at #84, litter present.

Manalapan Twp VA # 83

- Upstream turbid pond with some sediment deposition
- Downstream wetland filled with invasive plants.

Manalapan Twp #82

Thompson Grove Road culvert recently modified to serve local housing developments. Mitigation matting installed in stream and along outfall bank to minimize exposure of acid producing soils. Trees incapable of growing through matting.

Manalapan #80
SW & Pond Maintenance

- SW Basin and tributary flow into 2 ponds.
- Basin inlet & outlet structure needs vegetation removal.
- First pond has shrub buffer, but invasive plants are widespread, and pond lilies.
- Second Pond (no photos) has a mowed buffer, little shade, & lilies are widespread. Outlets for 2nd pond have collapsed and need repair.

Manalapan Twp #78
Main Stem

- Old Mill house, dam and large pond on Rte 527, on main stem of MB. Some pond lilies present.
- Dam in fairly good shape, but Mill house in disrepair and vacant.
- Area could be enhanced for recreational fishing.

Manalapan Twp #78
Main Stem eroded banks

Glauconitic sands & seeps.

- Downstream of the dam, the stream banks are eroded >6ft along a 75 ft stretch on the right bank and >4 for about 75 ft. on the left bank.
- High storm flows along the main stem need consideration for any restorations.

Manalapan Twp # 73
Iron Staining

Significant local commercial development.
High iron content visible in stream.
Some iron floc & bacteria observed in swale by station #72.

Manalapan #71
Drainage Construction

- Construction underway with direct drainage to tributary.
- No silt fencing present.
- Freehold SCD is monitoring and permits are in place.

Manalapan #69

- Area identified as state T&E wetland habitat.
- Habitats may be impacted by high iron content, sediment loading & sediment deposition upstream of road culvert, downstream widespread invasive plants.

Manalapan #68

- Area identified as state T&E wetland habitat.
- Habitats may be impacted by nutrients & sediment loading, and widespread lilies & invasive plants.

Manalapan #67

Kinney Road culvert recently modified to serve local housing developments. Mitigation matting installed in stream and along outfall bank to minimize exposure of acid producing soils.

Additional seeps are present, and downstream eroded banks. Monitoring, maintenance & mitigation should be required.

Manalapan # 67

Mitigation matting installed in stream and along outfall bank to minimize exposure of acid producing soils. Additional seeps are present, and downstream banks are eroded. Monitoring, maintenance & additional mitigation of eroded banks and seeps should be required.

Manalapan Construction #65

Significant construction in the area of stations #65, 64 & 63.

Construction of roadways, basins, outfalls to streams could be increasing sediment loads to the streams.

Manalapan Construction #64

Significant construction in the area of stations #65, 64 & 63.

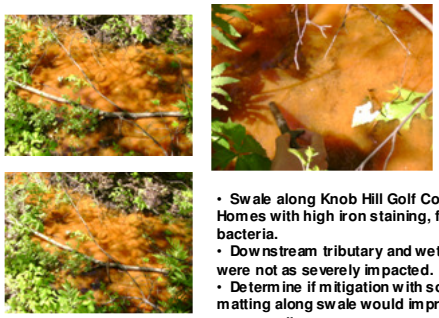
Construction of roadways, basins, outfalls to streams could be increasing sediment loads to the streams.

Manalapan # 63

Significant construction in the area of stations #65, 64 & 63.

Construction of roadways, basins, outfalls to streams could be increasing sediment loads to the streams.

Manalapan Twp # 61

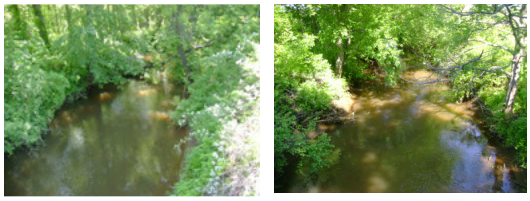


- Swale along Knob Hill Golf Course & Homes with high iron staining, floc and bacteria.
- Downstream tributary and wetlands were not as severely impacted.
- Determine if mitigation with soil matting along swale would improve water quality.

Manalapan #58

- Tributary to MB has eroded outer bank >5 ft at a bend. Eroded bank extends approximately 75 ft.
- Located by home/ yard - may be private land.
- Local area includes single homes and horse farms.

Manalapan Twp Main Stem at #56



Upstream and downstream of the main stem of the Manalapan Brook at station #56.

Manalapan #55

- Several local horse farms near this tributary to MB, possible impacts from fecal coliform.
- Paddock area fence runs along stream and banks are eroded > 3ft. Sediment bar at bridge.
- Mitigate with plantings inside and outside of paddock.

Manalapan #54 Main Stem

- Local horse farm on MB, possible impacts from fecal coliform.
- Paddock area impacted by erosion and possible flooding. Stream bank eroded > 4ft.
- Mitigate with plantings inside and outside of paddock.

Monroe Twp #52- main stem

- Significantly eroded banks > 6 ft for approximately 100 yards.
- High storm flows could impact restorations designs.
- Fallen trees increase eroded banks.
- Possible glauconitic sands present.

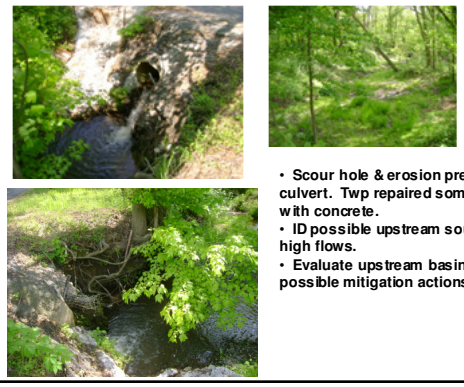
Monroe Twp #51-52

Horse farm and paddocks adjacent to stream and wetlands, could impact water quality with nutrients and fecal coliform.

Monroe #48

- Eroded stream bank of 2-3ft on tributary to MB.
- ID possible upstream source of high flows.
- Evaluate upstream basins for possible mitigation actions.
- Glauconitic sands & seeps exposed.

Monroe #47



- Scour hole & erosion present at culvert. Twp repaired somewhat with concrete.
- ID possible upstream source of high flows.
- Evaluate upstream basins for possible mitigation actions.

Monroe #46 MB Main Stem

- Recent completed new bridge on MB.
- Eroded stream bank of 2-3ft on MB.
- ID possible upstream source of high flows.

Monroe #45

New housing construction diverted tributary into culverts and impacted buffer.
Could increase nutrients and sediment loading to stream.

Monroe Twp #44

Eroded stream bank of >3ft on bend of tributary to MB.

Significant recent housing development in the areas.

ID possible upstream source of high flows.

Evaluate upstream basins for possible mitigation actions.

Monroe #43

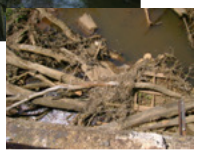
- Housing basin discharges to wetlands and old culvert under RR line.
- Upgrades needed for inlets, steel culvert, and wooden headwall.

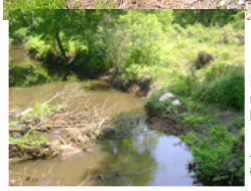
Monroe #42

Tributary is sewered through/ under housing development.

Maintenance and leaf removal needed on sewer inlet.

Monroe #41 Main Stem





Large fallen tree blocking MB flow under RR bridge. Need to remove blockage.

Access to floodplain, but banks are also eroded 2-3 ft.

Manalapan Brook – Part II
Visual Assessment Tour #38-1

April-May 2008

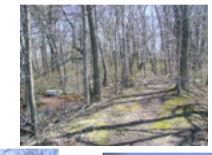
Manalapan Lake Dam #28

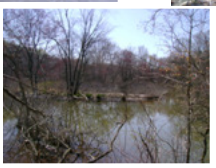
VA Station #22 ROW Monroe Township

Christine Altomari
Princeton Hydro
908-237-5660
www.princetonhydro.com

Assisted by:
NJWSA, Tara Petti
NJDEP Watershed Ambassador, Kristyn Morrison
Princeton Hydro, Mary Lambert

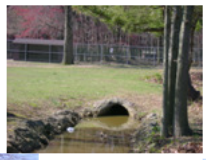
Manalapan Lake #38





Manalapan Brook meanders through wetlands as it enters Manalapan Lake. A berm dam separates the Brook from the Lake.

Jamesburg Manalapan Lake #37

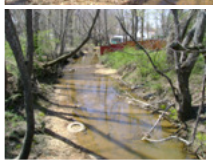


The Middlesex County owns and manages the Lake and Thompson park and zoo. The zoo houses over 50 ducks and other fowl, goats, and 87 deer in an enclosure. Runoff from the zoo is diverted to Manalapan Lake.

Monroe #32 William St Basin to Barclay Brook

Monroe Twp may be responsible for the maintenance of SW basins, and 1 ft of sediment was being removed from the channel & spread. The outlet has an 8" orifice. Flooding, erosion, undercutting of trees, roadway and sewer lines occur at the discharge point. The home installed a gabion retaining wall.

Monroe #32 William St Basin -Barclay Bk



The Discharge from the William St basin is causing flooding, bank erosion, sediment bars, and severe undercutting of trees, roadway and sewer lines. The home installed a gabion retaining wall. Bank erosion DS is also occurring.

Monroe #31 Old Forge Rd Barclay Brook

Unstable and eroded banks up to 4 ft at beds, and sediment bars depositions.

Monroe #30 Lake St
Barclay Brook

Eroded banks of 2-3 ft were observed, litter throughout the area, and flooding occurs in this very urban area. The outfall is undercut, and an old oil boom is present.

Wigwam Brook basins to #29

The Beaver Brook Apartments and Rossmoor homes and golf community discharge stormwater to Wigwam Brook, where downstream erosion is occurring. These developments are large and older basins & outlets could be retrofitted to reduce SW discharges.

Wigwam Brook #29

Development discharges runoff to Wigwam Brook and pond. Painted turtles were found in the bog.

Wigwam Brook #29

Extensive erosion (15-20 ft) and the exposure of glauconitic sands is occurring in this 100 yard ravine, causing flooding and sediment deposition downstream. Extensive mitigation is needed.

Wigwam Brook #29

Extensive erosion (15-20 ft) and the exposure of glauconitic sands is occurring in this 100 yard ravine, causing flooding and sediment deposition downstream. Extensive mitigation is needed.

Wigwam Brook 2005 Flooding & Dam removal

Princeton Hydro was hired by Beaver Brook Apartments to restore a hillside that collapsed from the 2005 storm. We were also tasked to remove an old dam from the stream. During that storm event a storm sewer also collapsed in this area and tons of sediment washed downstream to yards and homes, and Rte 32 was closed for days.

Wigwam Brook 2005 Flooding & Dam removal

Princeton Hydro was hired to restore a hillside that collapsed; remove an old dam from the stream; and possibly repair and a storm sewer that also collapsed next to this home. Note condition of stream in 2005, and color of stream & sediments.

Jamesburg Wigwam Bk DS of #29

Main issue here is the limited stream buffer, and encroachment of yards and fences in this floodplain and riparian corridor.

Jamesburg Wigwam Bk DS of #29

Downstream of the erosion at Station #29, Wigwam Brook had flooded homes, yards & roadways, and deposited large sediment piles. The stream enters an upgraded 4 ft storm sewer, and flows under Jamesburg.

Manalapan Lake Dam US #28

The Manalapan Lake Dam lies in the center of historic Jamesburg, a dense housing and commercial area, with a county roads and a railroad crossing. The dam was recently restored in 2007.

Jamesburg # 28 DS Dam

Downstream of the Manalapan Lake Dam is the confluence with Barclay Brook. Flooding and eroded banks (3 ft) occur and one resident erected a gabion wall. Buffers are limited, litter was widespread and a dumpster was in the stream.

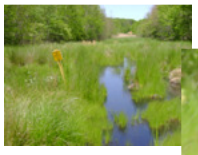
Jamesburg #28 – Behind RR Ave

Tributaries and wetlands within the forest buffer have been ditched to drain to MB. Acid producing sands have been exposed.

Monroe #26
Flooding, litter & ditched wetlands,

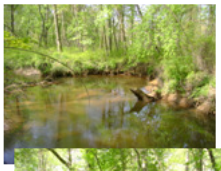
Local flooding occurs and street swales were filled with litter. Culverts filled with sediments. A utility line also runs through these wetlands.

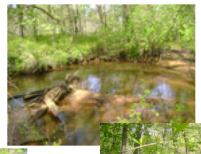
Monroe #24



- Utility ROW & wetlands were previously ditched to control mosquitoes. ROW maintenance includes routinely clearing, mowing and spraying for mosquitoes.
- These open wetlands provide habitat for green heron.
- Ditches also present in adjacent forested wetlands.

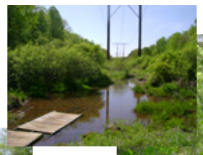
Monroe #22 MB Main Stem





MB main stem with eroded banks 3-4 ft for over 200 yards. Where trees fell they accelerate the erosion, and form sediment bars. Buffers were intact.

Monroe #22 ROW



- Utility ROW & wetlands were previously ditched to control mosquitoes. ROW maintenance includes routinely clearing, mowing and spraying for mosquitoes.
- Restoration of native grass may have occurred here.
- Ditches also present in adjacent forested wetlands.

Helmetta #17 & 18

Pink lady slipper orchid found on trails.

Helmetta Pond owned & maintained by Middlesex County.
Aerial spraying for gypsy moth during VA limited field time.
Area designated as federal T&E habitat, possible for bog turtle.
Possible bog habitat also present at end of John Street at #18.

Monroe #15 & 14

Monroe Twp may maintain some basins, where 1 ft of sediment was removed from the channel and spread. Local tributaries and wetlands in this area were dry, and hydraulic conditions may have been impacted by creation of large detention and wet basins.

Monroe #16 & 13 MB Main Stem

Stations 16 & 13 bridge crossings over the main stem of MB. Water appears turbid due to pollen. Retaining wall installed at private yard #13 covered with wisteria.

Monroe #8 & 7

Lots of new housing developments in this area. Headwaters of #8 were sewered. Sediment bars observed up & downstream at #7.

Monroe #11 South River

South River receives drainage from several housing developments.

Litter cleanup needed, and slight erosion present (2 ft).

ATV use in area.

Spotswood Wetlands # 10

May 13, 2008

Opening the DeVoe dam to reduce flooding may impact water levels in upstream wetlands by 1-2 ft. This impacts wetland ecology and habitats.

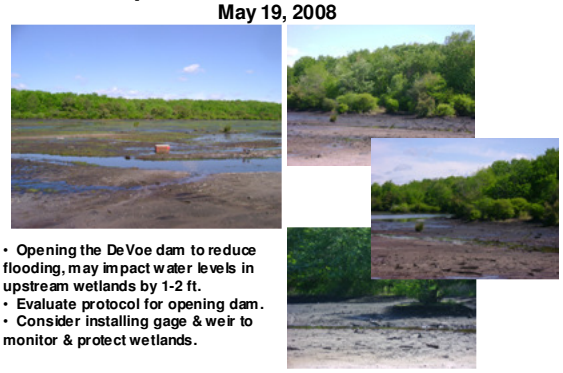
Spotswood Wetlands # 10

May 15, 2008

- Opening the DeVoe dam to reduce flooding, may impact water levels in upstream wetlands by 1-2 ft. This impacts wetland ecology and habitats.
- Evaluate protocol for opening dam.
- Consider installing gage & weir to monitor & protect wetlands.

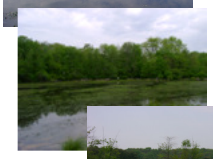
Spotswood Wetlands # 10

May 19, 2008



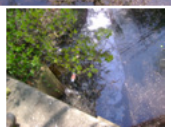
- Opening the DeVoe dam to reduce flooding, may impact water levels in upstream wetlands by 1-2 ft.
- Evaluate protocol for opening dam.
- Consider installing gage & weir to monitor & protect wetlands.

Spotswood wetlands #9 – May 15, 2008



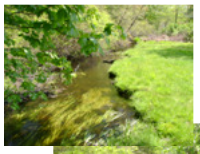
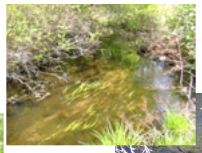
- Opening the DeVoe dam to reduce flooding, may impact water levels in upstream wetlands by 1-2 ft. This impacts wetland ecology and habitats.
- Evaluate protocol for opening dam. Consider installing gage & weir to monitor & protect wetlands.
- Several wood duck nests installed.

Monroe #6 – May 7, 2008



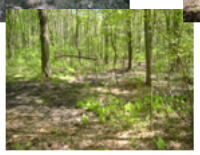
Station 6 is below the Spotswood wetlands, just upstream of DeVoe Pond. Really high pollen load gives stream a muddy appearance.

East Brunswick #5 Cedar Brook Trailer Park

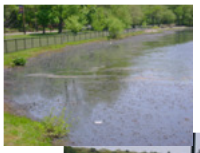
Cedar Brook runs behind a large trailer park. Significant macrophytes and algae were observed, and the stream should be tested for nutrients and E coli. The trailer park is likely served by sewer, but conveyance lines are old and underground holding tanks are used.

Spotswood #4 & 3 Cedar Bk Tributary



This tributary headwater starts in a sandy wetland area, which has been impacted by ATV use. A major outfall DS on Adirondack Ave is half filled with sediment, and sediment from a past cleaning was piled onsite. Flooding from DeVoe Lake in 2005 impacted this area, flooding the first floor of the adjacent house. Maintenance is needed at the outfall.

Spotswood #2 – DeVoe Lake



South River joins Manalapan Brook to form DeVoe Lake. Flooding, geese, shallow water, high water temperatures, and spreading macrophytes are concerns at the lake. The dam was restored after a significant flood in 2005 flood.

Spotswood #2 – Cedar Brook

Just upstream of the confluence of Cedar Brook and MB is a stream gage. The gage may be monitoring Cedar Brook rather than MB.

Spotswood #1

Below the DeVoe Lake & dam is the confluence where Cedar Brook joins Manalapan Brook, and flooding in Spotswood has occurred. Cedar Brook on the left is noticeably more orange in color. Banks are eroded by 2ft & sediment bars have formed. Downstream MB flows through a series of ponds and wetlands.

MANALAPAN LAKE WATERSHED RESTORATION / IMPLEMENTATION PLAN

INTERIM REPORT

Prepared for:

New Jersey Water Supply Authority
Watershed Protection Programs Unit
74 East Main Street
Somerville, NJ 08876-2312
Phone: 908-685-0315
Fax: 908-685-0195

Prepared by:

Princeton Hydro, LLC
1108 Old York Road
Suite 1, PO Box 720
Ringoes, NJ 08551
Phone: 908-237-5660
Fax: 908-237-5666
www.princetonhydro.com

November 2006

MANALAPAN LAKE WATERSHED
RESTORATION / IMPLEMENTATION PLAN

INTERIM REPORT

TABLE OF CONTENTS

Introduction....1
Water Quality Monitoring....1
Temperature....2
Dissolved Oxygen (DO)....3
pH....4
Conductivity....4
Water Clarity (Secchi Depth)....5
Discrete Water Analysis....5
Chlorophyll *a*....9
Plankton....10
Fish....12
Development of GIS Database under Various Land Use Scenarios and Refinement of the State's TMDL....14
Surface Runoff / Stormwater....16
Onsite Wastewater Treatment Systems (Septic Systems)....16
Internal Phosphorus Loading....17
Groundwater....17
Atmospheric....18
Phosphorus Budget Summary....18
Water Quality Monitoring and Conclusions Regarding the Phosphorus TMDL....20
Water Resource Protection Open Space Criteria Analysis....22
Wellhead Protection Areas....22
Groundwater Recharge Rates....22
Riparian Areas....23
Forests and Wildlife Habitat....24
Preserved Open Space....24
WRPOS Map....24
Municipal Open Space / Farmland Preservation Priorities....24
Summary, Conclusion and Recommendations....26

Introduction

This report provides an interim summary and analysis of work completed to date by Princeton Hydro, LLC to prepare a Restoration / Implementation Plan for the Manalapan Lake watershed, as requested by the New Jersey Water Supply Authority (NJWSA).

Manalapan Lake is a 48-acre impoundment of Manalapan Brook located in Thompson County Park, Monroe Township, Middlesex County, New Jersey (Figure 1 in Appendix A). The Manalapan Lake watershed encompasses 17,254 acres in Monroe and Jamesburg Borough in Middlesex County and the Townships of Manalapan, Millstone and Freehold in Monmouth County (Figure 2 in Appendix A).

In order to develop a detailed and site-specific Restoration / Implementation Plan that specifically addresses both in-lake and watershed-based issues of concern, a certain amount of baseline water quality and ecological data is required. Therefore, a limited water quality monitoring program was designed and implemented for Manalapan Lake and its watershed. The monitoring program included the collection and analysis of physical, chemical and biological data.

To ensure that the collected water quality and ecological data would be accepted for use by the New Jersey Department of Environmental Protection (NJDEP), Princeton Hydro prepared a detailed Quality Assurance Protection Plan (QAPP) identifying the protocols and methodologies associated with collecting the field data and conducting all necessary analyses. NJDEP approved the QAPP in 2004. Princeton Hydro is State-certified (State ID #10006) for the collection of water samples and *in-situ* field monitoring of temperature, pH, dissolved oxygen and conductivity using a multi-probe data sonde. All collected water samples were transported to Environmental Compliance Monitoring, Inc (ECM), a State-certified laboratory in Hillsborough, NJ, for analysis. Detailed information on the laboratory methodology used to analyze the collected samples is provided in the QAPP (Appendix B).

Water Quality Monitoring

The original scope of work for this project included three in-lake and stream sampling events. These events were conducted during the late summer (11 August 2004), fall (18 October 2004) and spring (18 April 2005) seasons to obtain information on the seasonal succession of the lake through the growing season. However, conditions in 2004 and the spring of 2005 were relatively wet and cool, which most likely did not reflect a “normal” water year relative to long-term conditions. Therefore, two additional summer sampling events were added to the scope of work (reflected in the August 2005 QAPP Addendum, Appendix B). These additional sampling events were conducted on 14 July and 16 August 2005.

During each sampling event, *in-situ* data were collected from two in-lake sampling stations (Figure 1 in Appendix A): a mid-lake sampling station located near the dam/outflow of the lake (ST-1) and a near-inlet sampling station located in the shallower, southeastern section of

the lake (ST-2). A calibrated Hydrolab Surveyor IV or Quanta data sonde was used to collect the *in-situ* data. These data were collected in profile, from surface to bottom at 0.5 to 1.0 meter intervals. The measured parameters included temperature, dissolved oxygen, pH and conductivity. Water clarity was also measured with a Secchi disk at each in-lake sampling station. The raw *in-situ* data are provided in Appendix C.

In addition to the *in-situ* monitoring, discrete samples were collected from the mid-lake sampling station and delivered to ECM, Inc. for the analysis of total phosphorus, soluble reactive phosphorus, alkalinity, hardness, total suspended solids and chlorophyll *a* concentrations. The discrete samples were collected approximately 0.5 meters below the water's surface with a Van Dorn sampling device.

A bottom water sample, collected approximately 0.5 meters above the sediments, was also collected during each in-lake sampling event and analyzed for total phosphorus. This bottom water sample was collected in order to calibrate and verify the lake's internal phosphorus load. The raw discrete water quality data are provided in Appendix C along with the *in-situ* data.

During each sampling event, *in-situ* data and discrete samples were also collected in Manalapan Brook, the main inlet entering Manalapan Lake. This sampling station, ST-3, is identified along Manalapan Brook in the lower left hand corner of Figure 1 (Appendix A). This station was also used to collect composited stormwater samples.

Sub-surface water samples were also collected at the mid-lake sampling station for phytoplankton and zooplankton analyses. Given the relatively shallow depth of Manalapan Lake, zooplankton samples were collected at a depth of approximately one half the total depth using a Schindler Plankton Trap. Detailed information on the zooplankton is necessary in order to objectively evaluate the potential applicability of a number of in-lake restoration techniques, including biomanipulation. The plankton data are provided in Appendix D.

Temperature

Temperature affects a number of physical, chemical, and biological processes in natural waters. It is controlled primarily by climatic conditions, but human activity can also have an influence. The temperature regime of a lake is a function of ambient air temperatures, as well as the morphometry and setting of the lake. One of the most biologically important temperature impacts is the decrease in oxygen solubility with increasing temperature. In other words, the higher the water temperature, the less dissolved oxygen that water can hold.

Another important ecosystem-based impact of temperature in lakes is the duration and strength of thermal stratification. That is, the temperature difference between the surface and bottom waters of lake can be large enough to essentially separate the bottom waters from atmospheric exchange. In productive waterbodies, this can result in a depletion of dissolved oxygen (DO) in the bottom waters and a substantial increase in the release of phosphorus from the sediments. Such conditions depend on the morphometry of a lake and its level of productivity.

Thermal stratification is typically defined as occurring when the water temperature declines by more than one degree (Celsius) over a depth of one meter. In Manalapan Lake, thermal stratification was detected on 11 August 2004 (Appendix C); on that date, from 1.5 m to 2.0 meters there was a 4-degree decline in water temperature. By October 2004, the lake was well mixed, which was also the case in April 2005. By mid-July 2005, the lake was once again thermally stratified. Such stratification was also detected during the mid-August 2005 sampling event. Thus, in spite of its relative shallow depth, Manalapan Lake does thermally stratify, at least in the area adjacent to the dam during the summer season. Such conditions are very typical of relatively shallow, highly productive, temperate waterbodies. During the summer months, the surface waters warm to a temperature sufficient to produce a density difference between the surface and bottom waters strong enough to result in thermal stratification. The impacts of such conditions during the summer months are explained below in detail.

Dissolved Oxygen (DO)

The amount of oxygen that can dissolve in water is subject to fluctuations caused in part by variations in temperature, photosynthetic activity, flow, vertical mixing and surface water agitation. Respiratory processes, oxidation of inorganic wastes and the decomposition of organic matter deplete DO, while photosynthesis and re-aeration by contact with the atmosphere increase DO concentrations in water. DO concentrations are important because it is essential for the survival of fish and the majority of other aquatic organisms. Most sensitive aquatic organisms (i.e. trout) require a DO concentration of 4.0 mg/L or greater for long-term survival. According to the State Surface Water Quality Standards criteria, surface water DO concentrations of 5.0 mg/L or greater are indicative of a healthy aquatic ecosystem.

The DO concentration of a lake is an important indicator of its overall "health". A large amount of information can be obtained on a lake ecosystem solely through the analysis of this parameter. DO concentrations are related to the photosynthetic activity of algae and aquatic plants; therefore, they provide insight into lake productivity. Vertical DO gradients (i.e., through the water column) provide an indication of mixing patterns and the effectiveness of mixing processes in a lake. DO concentrations also have an important influence on the physical-chemical properties of lakes and the composition of a lake's biota.

Manalapan Lake was well oxygenated (> 6.8 mg/L DO) from the surface to 1.5 meters during the mid-August 2004 sampling event (Appendix C). At the point where thermal stratification separated the surface waters from the bottom waters, DO concentrations were low (< 5 mg/L), and immediately over the sediments DO was anoxic (< 1 mg/L). Under anoxic conditions, the sediments liberate or “leak” substantially large amounts of phosphorus into the overlying waters relative to the oxygenated waters. This phosphorus, which originates from the sediments, can account for a large portion of the phosphorus available for algal growth, particularly during the dry summer months. This source of phosphorus is defined as internal loading.

Since Manalapan Lake was well mixed during the October 2004 and April 2005 sampling events, the lake was well oxygenated from surface to bottom, with DO concentrations typically greater than 10 mg/L (Appendix C). In addition to being well mixed, cooler water holds more DO relative to the warmer waters of the summer season.

While Manalapan Lake was thermally stratified by mid-July 2005, the bottom waters were not anoxic. However, the waters immediately over the sediments were below the 5 mg/L threshold (Appendix C). In contrast, the lake waters immediately over the sediments were anoxic (< 1 mg/L) during the mid-August 2005 sampling event (Appendix C).

In general, Manalapan Lake and its main inlet, Manalapan Brook, were well oxygenated during all five sampling events. During the summer months, depressed (< 5 mg/L) DO concentrations were detected in the bottom waters and anoxic conditions (< 1 mg/L) were detected in the waters immediately over the sediments. Such seasonal conditions are typical of shallow, productive waterbodies in the Mid-Atlantic region of the United States.

pH

The hydrogen ion activity in water provides an indication of the balance between acids and bases in solution. Hydrogen ion activity in water is usually reported as its negative logarithm, or pH. The pH scale ranges from 1 to 14 standard units. A pH of 7 indicates neutral conditions (pure or distilled water), while waters with a pH less than 7 are acidic and those with pH values greater than 7 are basic. Since pH is expressed on a logarithmic scale, each 1 unit change in pH represents a ten-fold increase or decrease in the hydrogen ion concentration. Therefore, a pH of 6 is 10 times more acidic than a pH of 7 and 100 times more acidic than a pH of 8. The pH of normal rainwater (containing no pollutants) is about 5.6. As the rainwater travels over and through rocks and soil, chemical reactions with minerals affect the pH and buffering capacity of the water.

pH is an important general water quality indicator because it is a major factor affecting most chemical and biological reactions. For most aquatic organisms, the optimal pH range is between 6.0 and 9.0. However, some organisms are adapted to unusually low pH values (such as in the New Jersey Pinelands, where the pH is typically in the 4.0 to 5.0 range).

The pH at Manalapan Lake during the 2004-2005 sampling program was typically acidic, varying between 6.1 and 6.9; the exception to this was in mid-October 2004, when in-lake pH values varied between 5.8 and 5.9 (Appendix C). As algae and aquatic plants photosynthesize, the pH of the surrounding waters will increase. Thus, the lower pH values in mid-October 2004 were most likely associated with minimal amounts of algal / aquatic plant photosynthesis.

Conductivity

Conductivity is a measurement of the capacity of water to carry an electrical current. It can also serve as an indirect way of measuring the amount of dissolved substances in the water;

the more dissolved substances, the higher the conductivity. Highly productive (eutrophic) waterbodies tend to have conductivity values greater than 0.5 mmhos/cm, while waterbodies with low levels of productivity (oligotrophic) tend to have conductivity values less than 0.1 mmhos/cm. The conductivity of Manalapan Lake generally varied between 0.18 and 0.20 mmhos/cm, which is indicative of a moderate level of productivity (mesotrophic).

Water Clarity (Secchi Depth)

Water clarity was measured in Manalapan Lake with a Secchi disk. For most laypeople, Secchi depths greater than 1.0 m (3.3 feet) are generally considered acceptable for recreational use. When the Secchi depth is less than 1.0 meter, most people perceive a waterbody as "dirty" or "scummy."

Secchi depths were generally acceptable in Manalapan Lake during the 2004-2005 sampling program. Secchi depth was greater than or equal to 1.0 meter during four of the five sampling events. The only sampling event when the Secchi depth was less than the 1.0 meter threshold was 14 July 2005, when the value was 0.5 meters (1.6 feet). As described below, this condition was attributed to a nuisance algal bloom. Such nuisance conditions, in terms of water clarity, were no longer presence in Manalapan Lake by mid-August 2005 when the Secchi depth was 1.25 meters.

Discrete Water Quality Data

As previously described, in addition to *in-situ* monitoring, discrete samples were collected from the in-lake and stream sampling stations under baseflow conditions. Composited samples were also collected from the stream sampling station under stormflow conditions. All samples were analyzed for a variety of chemical and biological parameters.

Discrete samples were collected during the five in-lake events at Stations 1 and 2; baseline tributary information was also collected at the main inlet, Manalapan Brook (Station 3). The discrete water samples were analyzed for:

1. Total Phosphorus (TP)
2. Soluble Reactive Phosphorus (SRP)
3. Alkalinity
4. Hardness
5. Total Suspended Solids (TSS)
6. Chlorophyll *a*

In-lake bottom water samples were also collected during each sampling event and analyzed for TP to aid quantifying Manalapan Lake's internal phosphorus load.

Phosphorus

Phosphorus is the primary limiting nutrient in most freshwater waterbodies within the Mid-Atlantic region of the United States. In other words, it takes very little phosphorus to stimulate large amounts of algal and/or aquatic plant growth; as phosphorus concentrations increase, the amount of algal and/or aquatic plant biomass will also increase. For example, one pound of phosphorus has the potential to produce 1,100 lbs of wet algae biomass. Thus, for many waterbodies, reducing current phosphorus loads, as well as controlling future loads, is an effective, long-term strategy for improving and preserving water quality.

Two forms of phosphorus were measured in Manalapan Lake. The first is total phosphorus (TP), which measures all the phosphorus in the water: inorganic, organic, particulate and dissolved. Most water quality models are based on in-lake TP concentrations, which make it a particularly useful water quality parameter to monitor.

Total Phosphorus

It has been well documented that in-lake TP concentrations greater than 0.03 mg/L can stimulate high levels of algal and/or aquatic plant growth. Under such conditions, a lake or pond is described as being eutrophic, meaning it is highly productive. Thus, such waterbodies have the potential to experience algal blooms and/or nuisance densities of aquatic plants.

The State has an established criterion for TP when no site-specific criterion is applied. Specifically, based on N.J.A.C. 7:9B-1.5(g)3, the surface waters of a lake or in a tributary at the point where it enters the lake shall not exceed 0.05 mg/L. Based on Princeton Hydro's in-house project experience with lakes located throughout New Jersey, New York and Pennsylvania, if the in-lake TP concentration is greater than 0.06 mg/L, and no large storms are expected within the next week, nuisance-level algal blooms will more than likely occur sometime over the next few days. Thus, the State's TP criterion generally agrees with results obtained from the field.

Surface water TP concentrations in Manalapan Lake varied from 0.02 mg/L in October 2004 to 0.04 mg/L in August 2004 and August 2005. The mean TP concentration of the five surface water samples collected at Manalapan Lake was 0.032 mg/L.

In contrast to surface water TP concentrations, deep water TP concentrations were excessive, varying between 0.06 mg/L in August 2005 to 0.250 mg/L in July 2005, with a mean of 0.120 mg/L. Such high TP concentrations in the deep waters, immediately above the sediments, are very common in temperate waterbodies. During the growing season, even a small difference between the surface and bottom water temperatures can result in weak stratification and a depletion of DO over the sediments. As shown in the *in-situ* data, DO concentrations immediately over the sediments were anoxic (< 1 mg/L of DO) during two of the five sampling events, which were August 2004 and August 2005. Such conditions result in chemical reactions which liberate substantially large amounts of phosphorus into the overlaying water. A storm or wind event can then easily transport this phosphorus-rich water to the surface and stimulate algal growth. This source of phosphorus is called internal loading.

As will be presented later in the report, the internal phosphorus load in Manalapan Lake is minor, chiefly due the small volume of water that becomes anoxic during the summer months, relative to the phosphorus loads entering the lake from the watershed. However, in order to incorporate the contribution of the internal phosphorus load to potential algal growth, a weighted mean that included the deep water TP concentrations was calculated for the five sampling events. The weighted mean TP concentration for Manalapan Lake, which includes the internal phosphorus load, was 0.04 mg/L. While this mean TP concentration is above the US EPA threshold for a highly productive lake ecosystem, it is below the State's water quality criterion of 0.05 mg/L. Thus, based on the limited data set, TP concentrations in Manalapan Lake are actually below the State standard. These results indicate that Manalapan Lake does not typically exceed the State standard and thus the TMDL should be re-assessed.

TP concentrations in Manalapan Brook, the main inlet of Manalapan Lake, under baseline conditions (i.e. no substantial storm event over the last 48 hours) varied from < 0.02 mg/L in October 2004 to 0.19 mg/L on 14 July 2005 (Appendix C). With the exception of 14 July 2005, the remaining four baseline inlet TP concentrations were below the State's criterion for TP in flowing waters of 0.10 mg/L.

Water samples were also collected from the Manalapan Brook sampling station during three storm events, which included:

- A 24-hr total of 1.52" of rain on 4 November 2004
- A 24-hr total of 0.85" of rain on 23 March 2005
- A 24-hr total of 1.56" of rain on 27 June 2005

The resulting stormwater TP concentrations exhibited a wide range of variation with 0.05 mg/L in November 2004, < 0.02 mg/L in March 2005 and 0.34 mg/L in June 2005. The low stormwater TP concentration during the March 2005 sampling event was probably due to the measurable amount of precipitation that feel over the pervious 72 hours (Appendix C). In any event, the resulting stormwater data indicates that Manalapan Brook can convey a large amount of phosphorus to Manalapan Lake.

Soluble Reactive Phosphorus

Soluble reactive phosphorus (SRP) measures the dissolved inorganic forms of phosphorus that are easily assimilated by algae for growth. If TP is considered food for algae and aquatic plants, then SRP can be considered "candy." Although other forms of phosphorus, such as organic phosphorus, can also be utilized by algae, they must exert more energy to assimilate such forms. Accordingly, the first type of phosphorus that algae and aquatic plants will utilize is SRP. This provides a valuable means of assessing potential water quality problems, because elevated SRP concentrations may indicate a potential algal bloom in the near future.

In most freshwater systems, SRP concentrations > 0.01 mg/L are enough to stimulate elevated amounts of algal and/or aquatic plant growth. SRP concentrations in Manalapan Lake ranged from 0.003 to 0.015 mg/L (Appendix C). Three of the five Manalapan Lake SRP

samples were at or above the >0.01 mg/L threshold, indicating that there is the potential for excessive algal and/or aquatic plant growth.

Inlet SRP concentrations were consistently below the 0.01 mg/L threshold except for 11 August 2006 when the SRP concentration was 0.06 mg/L. However, this data point is flagged as suspicious since the SRP concentration was higher than the TP concentration. Since SRP accounts for a portion of the total phosphorus in a water sample, it should not be higher in concentration relative to TP. Therefore, this data point was not considered in the conclusion that SRP concentrations are typically low in the main inlet of Manalapan Lake. More than likely, the majority of the phosphorus entering the lake from Manalapan Brook is adsorbed onto sediment particles.

Total Suspended Solids

Total suspended solids (TSS) is a measure of the amount of particulate matter in water. The State Surface Water Quality Standards limit for TSS is 25 mg/L for trout production (FW2-TP) and trout maintenance (FW2-TM) waters, and 40 mg/L for non-trout waters (FW2-NT). Under baseline (non-storm event) conditions, TSS concentrations greater than 25 mg/L can negatively impact aquatic habitats through in-filling of wetlands, lakes and waterways, the destruction of spawning habitat and add physiological stress on fish and macroinvertebrates through suspended sediments settling on their gills.

During the five in-lake sampling events, TSS concentrations in Manalapan Lake varied from < 3 to 6 mg/L, well below the 25 mg/L threshold. The inlet TSS concentrations were also generally low, varying between < 3 and 4 mg/L. The exception to this was on 14 July 2005 when the inlet TSS concentration approached the 25 mg/L threshold, being 22 mg/L (Appendix C). It should be noted that the elevated inlet TSS concentration in July 2005 correlated with the highest inlet TP concentration of 0.19 mg/L (Appendix C).

Inlet TSS concentrations during the three storm events were 3 mg/L on 4 November 2004, < 3 mg/L on 23 March 2005, and 27 mg/L on 27 June 2005. Again, the highest TSS concentration occurred during the same sampling event when the highest stormwater TP concentration was recorded. These results indicated that the bulk of the phosphorus entering Manalapan Lake through its main inlet, whether during baseline conditions or storm events, is adsorbed onto particulate matter (i.e. suspended solids).

Alkalinity and Hardness

Alkalinity and hardness are complimentary tests that respectively measure anion and cation solute concentrations.

Alkalinity is a measurement of the quantity of base present in water (e.g. bicarbonates, hydroxides, phosphates, etc.). Alkalinity controls the buffering capacity of a lake and its ability to resist pH changes, which acts as a stressor to aquatic ecosystems. Values over 20 mg/L are

generally considered the minimal level for normal function, while 200 mg/L represents the upper end of the desirable range. Ideally, alkalinity should range from 100 to 150 mg/L for optimum ecosystem function.

Alkalinity was generally low in Manalapan Lake, typically being less than 20 mg/L, as $CaCO_3$. During the August 2004 through July 2005 sampling events, the alkalinity varied from 5 to 10 mg/L, as $CaCO_3$ (Appendix C). In sharp contrast, the alkalinity measured on 16 August 2005 was 114 mg/L, as $CaCO_3$. The elevated alkalinity measured on 16 August 2005 may have been a temporary increase, as a result of the extremely large storm event that occurred approximately one month earlier.

On 17 July 2005, just three days after the in-lake / tributary baseline sampling event, between 7 and 8" of rain fell in Jamesburg Borough over approximately 20 minutes. This extremely large and severe storm event obviously caused flooding but it may be responsible for the elevated alkalinity measured a month later. As flood water moved over the land and drained into receiving waterbodies, a large amount of dissolved material is transported. These dissolved substances can contribute toward a substantial increase in alkalinity that can be measured for weeks. However, in spite of the elevated alkalinity measured in August 2005, the alkalinity of Manalapan Lake is generally low, which indicates the lake is susceptible to large changes or shifts in pH due to a low buffering capacity.

Hardness measures the concentration of Ca^{+2} (calcium) and Mg^{+2} (magnesium) ions, and, to a lesser extent, other polyvalent metals such as iron, aluminum and manganese, in the water. Specifically, "hard water" refers to the large amounts of soap needed to produce lather, or the deposit that forms on a sample container upon evaporation of the water. In terms of lake management, information on the hardness of a waterbody is particularly useful, especially when considering the use of copper-based algicides because toxicity to vertebrates increases in softer waters. These ions are also important for cell osmoregulation and the formation of bones and invertebrate exoskeletons. Ideal concentrations for hardness range from 75 to 200 mg/L. One commonly used classification scheme for hardness is the following scale: 0 to 60 mg of $CaCO_3$/L = soft, 61 to 120 = moderately hard, 121 to 180 = hard, and > 181 = very hard.

Hardness in Manalapan Lake ranged from 18.5 mg/L to 48.5 mg/L (Appendix C). Based on these results the lakewater is considered "soft". Thus, any application of a copper-based pesticide to control nuisance algae would be to conducted with great care since copper toxicity to vertebrates such as fish is higher in softer waters.

Chlorophyll a

An important biological parameter in assess in-lake water quality conditions is chlorophyll *a* (Chl *a*). Chl *a* is a photosynthetic pigment possessed by all algal groups. Since all algal groups contain chlorophyll *a*, measuring its concentration in lake water is an excellent means of quantifying the relative biomass of the phytoplankton within the open water of a lake. Concentrations of chlorophyll *a* are also used to gauge the in-lake productivity associated with

phytoplankton. In turn, this information can be used to quantify the trophic state of a waterbody, as well as measure the relative effectiveness of an implemented in-lake restoration technique.

To the layperson, chlorophyll *a* concentrations greater than 30 mg/m^3 produce algal blooms/surface scums that are considered unpleasant for recreational waterbodies. With the exception of 14 July 2005, chlorophyll *a* concentrations were well below the 30 mg/m^3 threshold, varying between 4 and 15.8 mg/m^3 (Appendix C). In contrast, an algal bloom occurred on 14 July 2005, when the chlorophyll *a* concentration was 86.4 mg/m^3. However, this algal blooms was "flushed out" of the lake approximately 3 days later after the 7-8" storm event. By 16 August 2005, a month after the severe storm event, the chlorophyll *a* concentration was 10.4 mg/m^3. These data indicate that Manalapan Lake has the potential to generate nuisance algal blooms, however, such blooms are limited to seasons or periods to time that receive little or no precipitation. As will be quantified with some water quality modeling later in the report, storm events quickly flushes algal blooms out of the lake. Such conditions were observed from July to August 2005, which was a direct result of the large 7-8" storm event.

Phytoplankton

Phytoplankton are algae that spend most of their life cycle freely floating in the open waters of a lake or pond. Many phytoplankton are grazed on by a variety of aquatic animals and thus for the base of the aquatic food web. High enough densities of phytoplankton can result in nuisance algal blooms or surface scums. In addition, many algae produce taste and odor problems in drinking water supplies and some cyanobacteria (a group of algae) produce cyanotoxins. Given their value as the base of the food web, as well as the potential problems they can produce in recreational and drinking water supplies, phytoplankton are considered an important group of organisms in the lake ecosystem.

During each in-lake sampling event, a whole lake water sample was collected and preserved with Lugols solution. The samples were then taken to Princeton Hydro's biological laboratory where the samples analyzed. Phytoplankton were identified to the lowest practical taxon, which in most cases is genus, and total abundance and biomass values were calculated. The results of the phytoplankton analyzes are provided in Appendix D.

On 11 August 2004, seven algal genera were identified in Manalapan Lake, with the dominant genus being the filamentous diatom *Melosira*. High densities of this alga can give the water a brown or turbid appearance. Only one small-celled blue-green alga (also called cyanobacteria) was identified in the lake at this time and it is not known to produce surface scum, taste and odor problems or generate cyanotoxins.

By 18 October 2004, twelve algal genera were identified in Manalapan Lake. Total algal abundance and biomass values were lower relative to August but *Melosira* remained the dominant algal genus. No blue-green algae were identified in Manalapan Lake during the 18 October 2004 sampling event.

While total algal abundance and biomass values on 18 April 2005 were similar to those observed on October 2004, only four genera were identified in the April 2005 sample. In sharp contrast to the 2004 samples no diatoms, including *Melosira*, were identified in the April 2005 sample. The dominant alga genus in April 2005 was the green alga *Coelastrum* (Appendix D). Again, no blue-green algae were identified in the August 2005 sample.

Total abundance and biomass more than doubled from April 2005 to July 2005. In the 14 July 2005 sample, 10 algal genera were identified with the dominant alga in terms of abundance being chrysophyte *Synura*. In contrast, the dominant algal genus in terms of biomass in July 2005 was *Melosira*. Both of these algae can give the water a brown or turbid appearance. In addition, at high enough densities, *Synura* can produce very unpleasant tastes and odors. One blue-green alga, the filamentous genus *Aphanizomenon*, was also identified in the July 2005 sample. This genus is well known to produce nuisance surface scums in lakes and ponds. It was the third most abundance alga in Manalapan Lake during the July 2005 sampling event.

While total abundance slightly increased from July 2005 to August 2005, total biomass substantially declined (Appendix D). These seemingly contradictory results were a due to the dominance of the August algal community by colonial, yet small-celled, blue-green algae. Three genera of blue-green algae accounted for approximately 69% of the total abundance on 16 August 2005 but only 40% of total biomass. All three blue-green algae, *Aphanizomenon*, *Aphanocapsa* and *Anabaena*, are well known to produce nuisance blooms and surface scums.

In conclusion, the filamentous diatom *Melosira* tends to be the dominant alga in Manalapan during the summer and fall months, with blue-green algae dominating the algal community during dry, hot conditions such as those experienced in August of 2005. While *Melosira* can give the lake a brownish color during the summer and fall seasons, green algae appeared to dominant the phytoplankton community in the spring. With the exception of the blue-green algae, the majority of the identified algae appeared to be potentially valuable sources of food for zooplankton.

Zooplankton

Zooplankton are the micro-animals that live in the open waters of a lake or pond. Some of the large-bodied zooplankton are a source of food for forage and/or young gamefish. In addition, many of these large-bodied zooplankton are highly herbivorous (i.e., algae eating) and can function as a natural means of controlling excessive algal biomass. Given the important role zooplankton serve in the aquatic food web of lakes, samples were collected for zooplankton as part of the Manalapan Lake monitoring program.

During the 11 August 2004 sampling event, the dominant group of zooplankton in terms of abundance was the rotifers, while the copepods were the dominant group in terms of biomass. Such conditions are common since rotifers are relatively small in size compared to cladocerans and copepods. One particular colonial rotifer, *Conochilus*, accounted for approximately 72% of the total abundance in the August 2004 sample. Rotifers primarily feed on bacteria and detritus, although a few genera feed on other rotifers. Thus, rotifers generally do not heavily graze on

phytoplankton. However, three herbivorous zooplankton, the cladocerans *Diaphanosoma* and *Ceriodaphnia*, and the copepod *Diaptomus*, were identified in the August 2004 sample.

From August 2004 to October 2004, zooplankton abundance slightly declined but biomass substantially increased. This was largely due to a shift within the zooplankton community in dominance from rotifers to cladocerans (Appendix D). In the October 2004 sample four herbivorous zooplankton were identified; three cladocerans (*Daphnia*, *Diaphanosoma* and *Ceriodaphnia*) and the copepod *Diaptomus*. *Daphnia* is a particularly large-bodied zooplankter that can have a substantial impact on the resident algae through grazing.

By April 2005 zooplankton abundance, biomass and diversity were low in Manalapan Lake. Only two genera of rotifers were identified at this time. Such results are common for temperate waterbodies. At the beginning of the growing season, the rotifers are the first zooplankton to return to the open waters of a lake. As seasonal temperatures increase, the cladocerans and copepods will return to the open waters.

From April 2005 to August 2005 there was a substantial increase in the zooplankton abundance, biomass and diversity in Manalapan Lake (Appendix D). Nine genera were identified in the sample, with the dominant group being the cladocerans. Combined, the abundance of the four herbivorous zooplankton identified in the August 2005 was 380 animals per liter. This high density of herbivorous zooplankton contributed toward the sharp decline in algal biomass from July to August. More than likely the large storm on 17 July 2005 flushed a large portion of the algae out of Manalapan Lake. Subsequent to the storm, the established population of herbivorous zooplankton in August 2005 kept algal densities low in spite of the dry and hot conditions, which tend to be favorable for high rates of algal growth.

Fishery Survey

Fishery surveys and their associated analyses provide critical information in assessing a lake ecosystem. Fish are generally the top predators of most temperate aquatic ecosystems, excluding raptors and various wading birds. As such, they fulfill varied roles in the ecological function of a lake. Fish can have a direct impact on water quality. For example, benthic dwelling species feeding off the bottom can increase turbidity in the water column. Fish also have the potential to effectively control varied invertebrate taxa, and in biomanipulation strategies are used to alter phytoplankton and zooplankton densities to avoid nuisance algae blooms. From a recreational perspective, fish are the most familiar aquatic organisms to the public, and are prized for their recreational value by anglers. In order to assess how the fishery community impacts the water quality of Manalapan Lake, a one day electroshocking fishery survey was conducted on 18 April 2005.

The electroshocking system employed during the fishery survey is a Coffelt VVP Electroshocking Unit and associated probes powered by a 5 HP Honda generator mounted on a 16 ft Boston Whaler. The electrofishing component of the fishery survey was conducted during daylight hours on 18 April 2005. Electrofishing focused primarily on the littoral sections of the lake. In total, six (6) transects were surveyed with the electrofishing equipment for 15 - 30

minute periods along each transect (Appendix D). The shoreline survey focused on areas with favorable fish habitat and structure including fallen trees, submerged structures, boat docks, rocks, and aquatic / wetland vegetation. Given the relatively small surface area of Manalapan Lake, the transects crossed over the lake's open water habitats.

A total of 11 species were identified during the spring 2005 fishery survey of Manalapan Lake with the total catch being 351. Of the 351 fish caught 76% were yellow bullhead, with the majority of these fish being within the size ranges of 3-6" and 6-9" (Appendix D). The yellow bullhead is a benthivorous species, feeding on organisms on and in the sediments. The feeding and excretory activities of benthivorous fishes are known to increase the phosphorus load originating from the sediments (i.e. the internal load). Given the high densities of yellow bullhead in Manalapan Lake, these fish probably account for a substantial amount of the internal phosphorus load, which in turn can account for a substantial amount of phosphorus during the dry summer months.

Development of GIS Database under Various Land Use Scenarios and Refinement of the State's TMDL

In order to better quantify existing and future impacts of land-based activities on the water quality of Manalapan Lake, it was necessary to generate a reasonably up-to-date land use/land cover GIS database for the Manalapan Lake watershed. As identified in the original project scope of work, the initial foundation for this watershed database was NJDEP's 1995/97 land use/land cover (LU/LC) data (NJDEP, 2000). The delineated watershed for Manalapan Lake and its associated LU/LC data are consistent with that used in NJDEP's *Total Maximum Daily Loads for Phosphorus to Address 5 Eutrophic Lakes in the Raritan Water Region* (NJDEP, 2003).

To ensure that the LU/LC database of the Manalapan Lake watershed represents existing conditions as closely as possible, the most recent aerial photographs were obtained and examined. As of early 2005, the most recent aerial photographs readily available for the Manalapan Lake watershed were those that were flown in the fall of 2002. A map of the watershed depicting the 1995/97 NJDEP LU/LC categories was superimposed on the 2002 aerial, and any changes noted between the two data sources were documented and used to update the LU/LC database. Specifically, land that was developed (i.e., converted to residential and/or commercial land uses) subsequent to the establishment of the 1995/97 database was identified, digitized and integrated in the LU/LC datalayer. The resulting modified LU/LC data for the Manalapan Lake watershed database are provided in Table 1. These data were also analyzed according to subwatershed and municipal boundaries (Appendix E).

While the modified LU/LC GIS datalayer is based on a visual survey of aerial photographs of the watershed and is by no means a definitively accurate representation of existing conditions, it does reveal some interesting development patterns. For example, based on a Princeton Hydro's comparison of the 1995/97 data with the 2002 aerials, the total amount of residential and "mixed urban" land within the Manalapan Lake watershed increased by approximately 35% and 10%, respectively. In contrast, agricultural land decreased by approximately 38%, while forested lands and wetlands remained relatively consistent. Based on these identified changes in land use, between 1995 and 2002, large tracts of agricultural land were converted into residential and other land uses, while development of forested lands or within wetlands was generally quite limited. Again, it is important to note that this represents only a generalized estimate of land use changes within the Manalapan Lake watershed over the past decade.

TABLE 1
Existing Land Use within the Manalapan Lake Watershed

(Data source: NJDEP 1995/97 land use/land cover data, updated by comparison to 2002 aerial photographs)

Lane Use/Land Cover	Hectares	Acres
Forest	1,308	3,230
Water	82	204
Wetlands	2,264	5,593
Barren Land	52	129
Urban	486	1,199
Agriculture	1,277	3,154
Commercial	56	140
High Density Residential	166	410
Industrial	21	51
Low Density Residential	1,270	3,136
Total	**6,982**	**17,246**

The modified GIS land use / land cover database was used to represent existing conditions within the Manalapan Lake watershed. In turn, these existing conditions were used to quantify the existing annual phosphorus load entering Manalapan Lake, originating from surface runoff.

Surface Runoff / Stormwater

Consistent with the original TMDL analysis, the Unit Aerial Loading (UAL) model was used to quantify the surface runoff contribution to Manalapan Lake's annual phosphorus load. Princeton Hydro used the updated/modified LU/LC categories and the same phosphorus loading export coefficients identified and selected by NJDEP in the original TMDL analysis (NJDEP, 2003) to conduct this analysis. The resulting annual total phosphorus (TP) load originating from surface runoff for the Manalapan Lake watershed was estimated to be 4,095 kg.

On-Site Wastewater Treatment Systems (Septic Systems)

The majority of residential areas within the Manalapan Lake watershed have sanitary sewer service. However, a limited number of watershed residents still rely on on-site wastewater treatment systems (i.e., septic systems). Although septic systems are not considered to account for a large portion of the annual TP load entering Manalapan Lake, this source was quantified to increase the accuracy of the analysis.

The most commonly used and cost-effective protocol used to quantify the annual phosphorus contribution originating from septic systems involves a model that incorporates information on the number of people per residence (per capita), soil type and conditions, and distance of leachfield to surface waterway/shoreline (USEPA, 1980).

The first step in using this model was to identify how many septic system leachfields exist within a zone of 100 meters (330 feet) along either the lake shoreline or any of the associated tributaries. USEPA studies have identified that, on average, septic leachfields within 100 meters of a waterway are a net source of phosphorus (USEPA, 1980). Thus, using GIS methodology, a 100-meter "zone of influence" was identified along all of the tributaries and the shoreline of Manalapan Lake. The six municipalities within the watershed were contacted to obtain information regarding current sewer service areas. Based on the existing available parcel (lot and block) data, any properties within the 100-meter septic zone of influence and were not identified as sewered, were categorized as being on septic. Based on the municipal data that was available at the time of this study, it was estimated that approximately 1,033 parcels of land utilize on-site wastewater treatment systems.

The most recent census data (2000) were used to calculate a per capita or average number of persons per dwelling within the septic zone of influence. For the municipalities within the Manalapan Lake watershed, the average number of persons per dwelling was estimated to be 2.5. The per capita data, along with an empirically-derived phosphorus loading coefficient for wastewater and selected soil retention coefficients (based on existing soils), were used to

quantify the annual TP load entering Manalapan Lake from septic systems within the zone of influence. This annual TP load was estimated to be 896 kg.

Internal Phosphorus Loading

As previously mentioned, internal regeneration is another potential source of phosphorus loading to lakes. In-sediment chemical reactions release substantial amounts of phosphorus into the overlying water column once the bottom waters become anoxic (DO concentrations < 1 mg/l). Phosphorus can accumulate in the bottom waters, and when the lake turns over—particularly during storm events—this phosphorus can be quickly transported to the surface waters, where it can stimulate high levels of algal and aquatic plant growth. This mechanism is defined as the internal phosphorus load and has been well documented to occur in both deep and shallow waterbodies. Under certain conditions, the internal load can account for a large proportion of a lake's annual phosphorus load, particularly during the dry summer months when surface runoff is minimal. Therefore, in order to develop a more accurate annual phosphorus load for Manalapan Lake, the internal load was quantified.

Based on the *in-situ* data collected during the five in-lake sampling events, it appears that Manalapan Lake thermally stratifies during the summer months, which results in anoxic conditions immediately over the sediments adjacent to the dam (Appendix C). In contrast, the lake is relatively well mixed and well oxygenated during the rest of the year. Using these data, it was estimated that anoxic conditions exist in Manalapan Lake during approximately 120 days of an average year (i.e., mid-May through mid-September). Thus, during this period of time negligible amounts of vertical mixing, as well as seasonally high water temperatures and bacterial activity, facilitate the depletion of DO over the sediments and the liberation of phosphorus.

Using the existing bathymetric data, it was estimated that approximately 16 acres (34%) of the bottom of Manalapan Lake becomes anoxic during the summer season. In order to quantify the internal phosphorus load, a number of TP release rates for oxic (with oxygen) and anoxic sediments were reviewed (Nurnberg, 1982; Mawson et al., 1983) and flux rates of 0.6 and 6.0 mg m^{-2} day^{-1} were selected, respectively.

The total annual anoxic and oxic internal TP loads for Manalapan Lake were 58 and 9 kg, respectively. Combined, the total amount of phosphorus released from the sediments of Manalapan Lake is estimated to be 57 kg per year.

Groundwater

A hydrologic budget analysis was conducted for the Manalapan Lake watershed, utilizing a combination of long-term precipitation records, existing land use information and other environmental factors such as land-based percentages of impervious surfaces and identified infiltration rates. Some of these factors not previously described were obtained from the water budget developed for the Raritan Basin (NJWSA, 2000). Using this information on the

Manalapan Lake watershed, the annual groundwater contribution to the lake's annual hydrologic budget was estimated to be in 82% agreement with the estimate provided by NJWSA (2000).

The annual hydrologic load originating from groundwater was multiplied by a mean TP concentration to quantify the annual TP load entering Manalapan Lake from groundwater/ baseflow. Using the TP concentrations measured in the main inlet, Manalapan Brook, during baseline (non-storm event) conditions, the mean TP concentration was 0.048 mg/L. It should be noted that one unusually high TP concentration, measured 14 July 2005, was not included in this analysis due to its unusually high value. The majority of the phosphorus entering a waterway from groundwater is in a dissolved form. However, during the 14 July 2006 sampling event, the soluble reactive phosphorus (SRP) concentration was an order of magnitude lower than the TP concentration, while the TSS concentration was moderately high. These data indicate that the majority of the phosphorus flowing through Manalapan Brook at this time was adsorbed onto sediment particles and most likely did not originate from groundwater. Thus, in order to minimize any error associated with including this TP value, it was removed from this analysis of quantifying the phosphorus originating from groundwater.

Based on the calculations made as part of this study, it was estimated that groundwater accounted for approximately 764 kg of TP per year. However, it should be emphasized that this value may be an overestimate of the amount of phosphorus entering the lake through groundwater, since baseflow in Manalapan Brook was assumed to approximate groundwater conditions. Direct groundwater samples should be collected and analyzed to more accurately determine the annual phosphorus originating from groundwater.

Atmospheric

The final source of phosphorus quantified for the Manalapan Lake watershed analysis was direct precipitation. The atmospheric deposition or dryfall of phosphorus directly onto the lake's surface was obtained from NJDEP's phosphorus TMDL analysis (NJDEP, 2003). A TP loading coefficient of 0.07 kg/ha/yr was used to quantify the atmospheric deposition of phosphorus. This coefficient was derived from a Statewide mean concentration of total phosphorus from the New Jersey Air Deposition Network (Eisenreich and Reinfelder, 2001; Koelliker et al., 2004). Using this coefficient, the resulting annual TP load originating from atmospheric sources was 1.4 kg.

Phosphorus Budget Summary

Each of the major sources of phosphorus for Manalapan Lake was categorized into one of five main sources. Their relative contributions are shown in Table 2. Surface runoff, originating from stormwater and flowing over the land and into the receiving waterways, accounted for 70% of the annual TP load entering Manalapan Lake. Septic systems and groundwater accounted for approximately the same proportions of the annual TP load: 15% and 13%, respectively (Table 2). However, as previously mentioned, the groundwater contribution may actually be lower than the

estimated annual load; some sampling and analysis of groundwater for phosphorus is needed to make this determination.

Internal phosphorus loading accounted for only 1% of the total annual TP load for Manalapan Lake. However, in contrast to groundwater, the internal phosphorus load may have been underestimated. The estimated amount of internal TP loading was based on oxic and anoxic rates of phosphorus release from the sediments. However, biological sources can also contribute to internal phosphorus loading. For example, the fishery survey conducted at Manalapan Lake on 18 April 2005 revealed that over 75% of the collected fish were yellow bullhead catfish. These fish are benthivorous, feeding primarily on the macroinvertebrates and detritus on and within the sediments. The feeding and excretory activities of these fish are known to transfer sediment-bound phosphorus into the water column, making it readily available for algal growth. Since this source of internal phosphorus loading was not quantified and a benthivorous fish was the dominant species in Manalapan Lake, it is likely that the internal phosphorus load accounts for more than 1%. However, it should be emphasized that even with the possible variation associated with the sources of TP, surface runoff still remains the dominant source of phosphorus for Manalapan Lake (Table 2).

TABLE 2
Annual Phosphorus Budget for Manalapan Lake

Sources of Pollutants	kilograms	pounds	Percent Contribution
Surface Runoff	4,095	9,029	70
Septic Systems	896	1,976	15
Internal Loading	57	123	1
Groundwater	764	1,685	13
Atmospheric	1.5	3	< 1
Total	**5,814**	**12,819**	**100.0**

Water Quality Monitoring and Conclusions Regarding the Phosphorus TMDL

In order to "translate" predicted phosphorus loads and measured phosphorus concentrations into variables that can be used to directly assess environmental and aesthetic impacts, several water quality models were utilized. Originally, these models were to be used to assess the current, future (built-out conditions) and reference (no human activity or occupancy within the watershed) conditions impacting the water quality of Manalapan Lake. However, as described below, the models have now been used to assess the applicability of ascribing a phosphorus TMDL to Manalapan Lake.

The first step in this water quality model assessment involved calculating the phosphorus retention coefficient for Manalapan Lake; that is, the percentage of the annual phosphorus load that is retained in the lake. This value is important in that it largely determines the amount of phosphorus available for algal uptake. Waterbodies with a substantial annual hydrologic load flush frequently, typically have lower phosphorus retention values and usually (but not always) support fewer large algal blooms than do infrequently flushed waterbodies.

The importance of flushing on phosphorus availability and trophic state stems from its relationship with the areal waterload (q_s). The areal waterload is a function of the lake's surface area and its annual amount of water outflow. The areal waterload was used to calculate the phosphorus retention coefficient using Equation 1 (Kirchner and Dillon, 1975).

Equation 1: $$R = 0.426e^{(-0.271qs)} + 0.574e^{(-0.00949qs)}$$

Where: R = Phosphorus Retention

q_s = Areal Waterload = $\frac{\text{Annual Outflow from Lake}}{\text{Surface Area of Lake}}$

e = 2.718 (natural log)

Typically, lakes and impoundments with phosphorus retention coefficients greater than 0.6 (60%) are productive and prone to excessive algal blooms. Using the long-term precipitation database (NJWSA, 2000), the phosphorus retention coefficient for Manalapan Lake was calculated to be 0.11. That is, only 11% of the phosphorus entering Manalapan Lake remains; the other 89% of the phosphorus leaves the lake through the outflow. Such results are typical for a small impoundment with a large watershed. Using the 2003 water year data, the phosphorus retention coefficient was even lower (0.09). Given these hydrologic and pollutant loading characteristics, the link between the large external phosphorus load and potential algal blooms and associated water quality problems is weak in Manalapan Lake.

Further evidence of this is provided when examining the watershed to lake area ratio. For most lakes and reservoirs, a watershed to lake area ratio is considered large when it is approximately 100:1. In the case of Manalapan Lake, this ratio is 362, which indicates that

extremely large reductions in the watershed nutrient loads are required to produce a measurable decline in productivity. Thus, while the external TP load is extremely large, only a small portion of the incoming phosphorus (11% as revealed by the phosphorus retention coefficient) will be utilized by algae within the lake. This indicates that in order to attain a measurable reduction relative to in-lake water quality conditions, an extremely large reduction in the existing TP load is required. Thus, the targeted reduction in the existing TP load for Manalapan Lake was calculated to be 86%, as established in the TMDL (NJDEP, 2003).

The next step in the water quality modeling process was to predict the in-lake (steady-state) annual TP concentration for Manalapan Lake. NJDEP conducted a survey of a number of commonly utilized empirical models and the Reckhow model (1979a) was selected as the most appropriate for the lakes, reservoirs and impoundments of New Jersey (NJDEP, 2003). The Reckhow model is relatively robust and is generally applicable to temperate waterbodies that fall within an identified range of in-lake and mean influent TP concentrations, areal water loads and areal TP loads. Using empirically derived data for Manalapan Lake, it was identified that while some of these water quality parameters approached the model's upper range of acceptable values for application, they were still within the acceptable and established ranges for use. Thus, the Reckhow model was used to model steady-state, in-lake TP concentrations in Manalapan Lake.

Equation 2: $[TP] = L / (11.6 + 1.2 * qs)$

Where:

[TP]	=	Predicted mean TP concentration (mg/L)
L	=	areal phosphorus loading ($g/m^2/yr$)
qs	=	hydraulic retention time (yr)

Utilizing the revised annual TP load of 5,814 kg (Table 2), the Reckhow annual TP concentration for Manalapan Lake was calculated to be 0.132 mg/L. This predicted in-lake mean annual TP concentration is substantially higher than the measured mean surface water TP concentration of 0.032 mg/L. As previously described, this mean TP concentration is based on data collected during the five lake sampling events.

In order to account for the elevated TP concentrations in the bottom waters during each sampling event, a weighted mean was calculated that combined surface and bottom TP concentrations. This proportional average, 0.040 mg/L, was still substantially lower than the predicted TP concentration of 0.132 mg/L. Thus, although in theory the Reckhow model is appropriate for Manalapan Lake, its actual application severely overestimates the mean TP concentration.

To obtain a better understanding of the ecosystem processes within Manalapan Lake, a deviation analysis of Carlson's trophic state models was conducted. This analysis compares the total phosphorus, Secchi depth and chlorophyll *a* variables to better define water quality relationships (Carlson and Havens, 2005). Based on this analysis, there tends to be a surplus of phosphorus associated with non-algal particles (i.e., suspended sediments). These non-algal particles are also frequently responsible for low water clarity and turbid conditions. Thus, based

on the limited amount of data collected to date, the generally unacceptable water quality conditions are primarily attributed to suspended dissolved and/or particulate solids, which can originate from external (surface runoff, streambank erosion) and/or internal (benthic activities of the large population of yellow bullhead) sources in Manalapan Lake. Additionally, the filamentous diatom *Melosira* can also contribute to the lake's turbid conditions. However, this alga tends to begin growing over the sediments and is then transported to the surface waters as a result of wind and wave activity.

Water Resources Protection Open Space Criteria Analysis

The purpose of performing this analysis was to identify and prioritize areas within the Manalapan Lake Watershed where protection from development impacts is most likely to protect water quality. For this task, Princeton Hydro refined the methodology outlined by the Raritan Basin Watershed Management Project's 2002 "Water Resources Protection Open Space Criteria" (WRPOS) report using the updated digital data described below. The WRPOS model is based on several widely-available GIS coverages, each encompassing one or more criteria identified by a subcommittee of the Raritan Basin Project as critical for water resource protection.

The following is a description of the refined methodology and criteria Princeton Hydro used to perform this analysis, as compared to the original WRPOS analysis conducted by the Raritan Basin subcommittee.

Wellhead Protection Areas

The purpose of this criterion is to protect areas where potential groundwater pollution could pose a threat to public water supply wells. Similar to the Raritan Basin methodology, Princeton Hydro used data provided by NJDEP. However, because the Raritan Basin report does not identify the year the Wellhead Protection data was produced, it is unclear whether the WRPOS analysis included the 2004 coverage used by Princeton Hydro or an earlier version. Princeton Hydro also adhered to the WRPOS methodology by including only Tier 1 and Tier 2 Wellhead Protection Areas and public community supply wells rather than private wells.

Groundwater Recharge Rates

The purpose of this criterion is to protect areas that contribute the largest amount of groundwater recharge. The WRPOS model is based on groundwater recharge rates calculated from the New Jersey Geological Survey GSR-32 analysis, combined with NJDEP's 1995/97 LU/LC dataset. The Raritan Basin subcommittee determined that area that contribute 25% of the recharge should be preserved. Consistent with the WRPOS methodology, Princeton Hydro utilized the New Jersey Geological Survey's (NJGS) current GIS dataset that represents the results of the GSR-32 analysis. The digital data ranks each area of groundwater recharge as category A, B, C or D, with A representing the highest amount of recharge and Rank D

indicating the lowest (measured by inches/year). (Recharge rates were calculated on a by-county basis; recharge rates by rank vary for each county.)

Taking a more conservative approach than the WRPOS model, which was limited to the area contributing 25% of the watershed's total recharge, Princeton Hydro included all land within the top two ranks (A and B) for the entire watershed.

Riparian Areas

The purpose of this criterion is to protect undeveloped areas adjacent to streams which provide flood protection, wildlife habitat and/or other water quality benefits. To precisely define riparian boundaries, field verification is essential. However, for an area as large as the Manalapan Lake watershed, physically mapping the riparian areas would be impractical, very costly and beyond the scope of this project. To delineate riparian areas in the watershed as accurately as possible without "ground truthing," the Raritan Basin subcommittee used several existing GIS datasets to create an integrated GIS coverage:

- Wetlands. Consistent with the WRPOS model, Princeton Hydro used NJDEP's wetlands dataset, a subset of the 1995/97 Land Use/Land Cover dataset. Only wetlands adjacent to a stream and over one (1) acre in size were included.
- Wildlife Passage Corridors. Riparian corridors provide safe passage for wildlife from one habitat area to another. These Wildlife Passage Corridors are calculated by delineating a buffer area along all streams within the watershed. First- and second-order streams were buffered 150 feet on each side, and all third-order streams and above were buffered 300 feet on each side.
- Floodplains. For this analysis, the Federal Emergency Management Agency (FEMA) 100-year flood zone was incorporated in the GIS database.
- Steep Slopes. Consistent with the WRPOS methodology, any slope greater than 15% that encroaches on a riparian area as defined by any other parameter listed here (i.e., wetlands) was included. Princeton Hydro used a 10-meter Digital Elevation Model (DEM) to model the elevations of the watershed. From the DEM, contours for the entire watershed were interpolated and slopes greater than 15% were identified. Using these contours, steep slopes that flow directly into a riparian area were identified and included in the analysis.
- Soils. All soils classified as hydric and alluvial that are also directly adjacent to a riparian area were included in the analysis. Princeton Hydro used digital soils data obtained from the USDA Natural Resource Conservation Service (NRCS).

The WRPOS methodology included one additional input: a water quality/filter zone. This area was deemed important for maintaining vegetative cover to provide stream shading, maintain cooler water temperatures, and filtering pollutants (such as phosphorus or nitrogen) before they enter the stream and degrade water quality. The WRPOS model defines this area as

100 feet on each side of the streams. Princeton Hydro omitted this analysis because this entire area was already included within the Wildlife Passage Corridors coverage.

Forests and Wildlife Habitat

The purpose of this criterion is to protect high-quality, vegetated areas that provide wildlife habitat and protect water resources by slowing runoff, retaining sediment, allowing groundwater recharge and maintaining cooler surface water temperatures. To develop this coverage, Princeton Hydro refined the WRPOS model with updated digital data. The coverage is comprised of three datasets: "dense forests," "emergent wetlands" and "forested wetlands." All three are part of the NJ Division of Fish and Wildlife's Landscape Data Program, which has been updated since the Raritan Basin subcommittee first ran the WRPOS analysis. Princeton Hydro utilized the updated version of the Landscape data for this analysis. The "dense forests" coverage was developed by creating 400-foot buffers for all Forest LU/LC polygons (from NJDEP's 1995/97 LU/LC dataset). All three inputs were merged together in GIS.

Preserved Open Space

The purpose of this criterion is to identify areas of permanently protected open space that could potentially be augmented and/or connected to other open space sites. The 2002 Green Acres Open Space Program data was used in the original WRPOS model. For this analysis, Princeton Hydro combined the updated 2004 Green Acres Open Space data with data from the Department of Agriculture's Farmland Preservation Program and open space data from the counties and municipalities within the watershed. Once again, all data inputs were merged within GIS.

WRPOS Map

After all data specified for each criteria above were collected and finalized, all criteria input files were converted to an ESRI GRID format, overlaid on top of one another and combined to create an output that identified areas where all inputs intersected one another. Within the output database, the number of inputs in each particular area was tallied. Figure 3 provides a graphic depiction of the number of refined WRPOS criteria found within each identified area (Appendix A).

Municipal Open Space / Farmland Preservation Priorities

In order to create a prioritized list of critical open space areas within the watershed, a review of the Master Plans of all watershed municipalities was conducted. Based on this review, a selected list of open space goals and areas targeted for land acquisition was compiled for each municipality (Appendix E). In addition to WRPOS criteria, priority areas were selected based on recreational values and public accessibility, consistent with municipal goals for open space

protection/preservation. In some cases, areas outside the watershed boundary were included to provide more information regarding potential links to or extensions of existing or future open space protection efforts.

Summary, Conclusions and Recommendations

In 2004, Princeton Hydro was selected by the New Jersey Water Supply Authority (NJWSA) to develop a Restoration / Implementation Plan for Manalapan Lake and its watershed to comply with NJDEP's targeted 86% reduction of the annual total phosphorus (TP) load entering Manalapan Lake, as per the established Total Maximum Daily Load (TMDL) (NJDEP, 2003). As part of this plan, selected water quality and ecological data were collected on Manalapan Lake and Manalapan Brook, the lake's main inlet, to determine if the TMDL's modeled TP concentrations reasonably agree with existing in-lake concentrations.

While the Manalapan Lake dataset was limited in size and scope (five sampling events over the course of 2004 and 2005), existing TP concentrations diverged significantly from modeled concentrations. The mean measured TP concentration (0.04 mg/L) in Manalapan Lake was substantially lower than the predicted TP concentration (0.13 mg/L) based on the Reckhow model (1980). In fact, the mean growing season TP concentration in Manalapan Lake was below the State Surface Water Quality Standard (SWQS, N.J.A.C. 7:9B – 1.14(c)5) of 0.05 mg/L for TP in a freshwater lake. Since the in-lake TP concentrations were below the State's water quality criteria threshold for TP, it was decided to re-examine the potential suitability of a TMDL for TP in Manalapan Lake.

While the hydrologic and morphometric parameters of Manalapan Lake fall within the appropriate range of characteristics for the Reckhow model (NJDEP, 2003), the model did not reasonably predict in-lake TP concentrations. Thus, for Manalapan Lake the Reckhow model was not applicable. Beyond the Reckhow model, the fact that the in-lake TP concentrations were below the State's criteria indicates that the total phosphorus TMDL is not the most appropriate means of restoring and managing Manalapan Lake and its watershed. If the in-lake TP concentrations are already meeting the State standard, the reduction in the annual TP load stipulated by the TMDL is not necessary or even potentially feasible. In addition to the low measured TP concentrations relative to the modeled concentrations, a number of other factors suggest that the TMDL approach should not be used for Manalapan Lake. These include:

1. There was not a strong link between TP and chlorophyll *a* concentrations in Manalapan Lake. Thus, reducing the TP loads and concentrations may not necessarily result in improved water quality conditions.

2. Based on some inter-relationships among various in-lake trophic parameters (TP, chlorophyll *a* and Secchi depth), the highly turbid conditions experienced in Manalapan Lake tended to be the result of inorganic particulate material and not algal blooms (Carlson and Havens, 2005).

3. In addition to visual evidence of streambank erosion, another observed potential source of the inorganic turbidity in Manalapan Lake was the composition of the lake's fishery community. Of over 350 fish collected during an April 2005 fishery survey of the lake, 75% of the fish were identified as yellow bullhead (*Ameiurus natalis*). This fish is a benthic feeder which stirs up the sediments through feeding activities. Thus, the large

population of yellow bullhead may be a major contributing factor to the turbid conditions of Manalapan Lake.

When collectively presented, the points described above and derived from the water quality and ecological data indicate that reducing the existing TP load to the targeted TP load, as identified in the TMDL, would not necessarily result in the desired improved water quality conditions for Manalapan Lake. In addition, based on the collected data, the lake is already in compliance with the State's numerical criteria for total phosphorus in a lake ecosystem. Therefore, based on these data, Princeton Hydro presented the following interim conclusions to NJWSA and NJDEP:

1. In the case of Manalapan Lake and its watershed, the total phosphorus TMDL approach is not the most appropriate means of restoring and managing these ecosystems.

2. The pollutant of primary concern for the Manalapan Lake watershed should be total suspended solids (TSS), not TP.

3. A watershed-based, stream assessment approach should be taken to develop a Watershed Protection & Restoration Plan for the Manalapan Lake watershed instead of the previously recommended lake-based TMDL approach.

As a result of these interim conclusions and with NJDEP concurrence, NJWSA requested a modified Scope of Work from Princeton Hydro to develop a revised Watershed Protection & Restoration Plan with an emphasis on TSS. The revised plan expands the study area to include the entire Manalapan Brook watershed, instead of terminating where the brook enters Manalapan Lake. The amended Scope of Work, provided in Appendix F, reflects the tasks required to develop a Watershed Protection & Restoration Plan for the entire Manalapan Brook watershed to the point where the South River is formed by the confluence of the Manalapan Brook with the Matchaponix Brook.

A very limited amount of water quality monitoring will be conducted as part of this proposed revised Scope of Work. Specifically, this will include the collection of water samples from Manalapan Lake and two other waterbodies within the Manalapan Brook watershed during three additional sampling events. These water samples will be analyzed for TP and TSS and *in-situ* monitoring for temperature, dissolved oxygen, pH, conductivity and Secchi depth water clarity will be conducted. This supplemental monitoring program will be submitted to NJDEP as an addendum to the original and approved QAPP (Appendix F).

In-Situ Monitoring for Manalapan Lake 11 August 2004							
Station	**DEPTH (meters)**			**Temperature**	**Conductivity**	**pH**	**Dissolved Oxygen**
	Total	**Secchi**	**Sample**	**(^{0}C)**	**(mmhos/cm)**	**(units)**	**(mg/L)**
ST-1	**3.0**	**1.8**	**Surface**	24.86	0.186	6.59	7.25
			0.5	24.77	0.187	6.58	6.89
			1.0	24.65	0.186	6.57	7.43
			1.5	24.58	0.187	6.45	7.29
			2.0	20.56	0.203	6.14	3.97
			2.5	20.36	0.206	6.15	2.53
			3.0	20.48	0.323	6.55	0.92
ST-2	**1.3**	**1.0**	**Surface**	24.83	0.833	6.54	0.47
			0.5	23.38	0.87	6.60	0.54
			1.0	23.13	0.87	6.66	0.62
			1.3	23.07	0.875	6.77	0.71
Inlet (stream)	**0.205**	**0.205**	**0.2**	22.15	0.241	6.44	8.09

Manalapan Lake

Sample Date **11-Aug-04**

STATION	mg/m^3 CHL *a*	SRP	TP	mg/L TSS	Alkalinity	Hardness
ST 1 - midlake (near dam) - surface	4	0.015	0.040	ND <3	10.00	18.50
ST 1 - midlake (near dam) - deep	--	--	0.100	--	--	--
ST 2 - undredged section	--	--	--	--	--	--
ST 3 - inlet (brook)	--	0.060	0.050	3	--	--

In-Situ Monitoring for Manalapan Lake 18 October 2004							
Station	**DEPTH (meters)**			**Temperature**	**Conductivity**	**Dissolved Oxygen**	**pH**
	Total	**Secchi**	**Sample**	**(^{0}C)**	**(mmhos/cm)**	**(mg/L)**	**(units)**
ST-1	**2.6**	**1.0**	**0.4**	13.23	0.18	10.51	5.84
			1.0	12.99	0.18	10.47	5.84
			2.0	12.47	0.18	10.24	5.83
			2.6	12.44	0.18	10.35	5.9
ST-2	**0.6**	**0.6**	**0.6**	10.78	0.19	9.56	5.6
Inlet	**N/A**	**N/A**	**Surface**	10.6	0.19	11.64	5.77

N/A = not applicable

Manalapan Lake

Sample Date **18-Oct-04**

STATION	mg/m^3 **CHL *a***	**SRP**	**TP**	mg/L **TSS**	**Alkalinity**	**Hardness**
ST 1 - midlake (near dam)	15.800	0.004	0.020	ND <3	7.5	41.6
ST 2 - undredged section	--	--	--	--	--	--
ST 3 - inlet (brook)	--	0.003	ND <0.02	ND <3	--	--

Manalapan Lake

Sample Date **04-Nov-04** composited stormwater sample

	mg/L	
STATION	**TP**	**TSS**
ST 3 - inlet (brook)	0.050	3.000

NOTES:	**Amount**	**Station ID**	**Station Name**
Rainfall for 24-hour period	1.16"	286055	New Brunswick 3 SE
	1.52"	283181	Freehold Marlboro
Rainfall for previous 72 hours	0.00"	286055	New Brunswick 3 SE
	0.00"	283181	Freehold Marlboro

http://climod.nrcc.cornell.edu

Manalapan Lake

Sample Date **23-Mar-05** composited stormwater sample

	mg/L	
STATION	**TP**	**TSS**
ST 3 - inlet (brook)	< 0.02	< 3

NOTES:	**Amount**	**Station ID**	**Station Name**
Rainfall for 24-hour period	1.03"	286055	New Brunswick 3 SE
	0.85"	283181	Freehold Marlboro
Rainfall for previous 72 hours	0.17"	286055	New Brunswick 3 SE
	0.21"	283181	Freehold Marlboro

http://climod.nrcc.cornell.edu

In-Situ Monitoring for Manalapan Lake 18 April 2005							
Station	**DEPTH (meters)**			**Temperature**	**Conductivity**	**Dissolved Oxygen**	**pH**
	Total	**Secchi**	**Sample**	**(^{0}C)**	**(mmhos/cm)**	**(mg/L)**	**(units)**
ST-1	**2.5**	**1.0**	**Surface**	11.18	0.204	8.53	6.51
			1.0	12.27	0.202	10.10	6.44
			2.0	12.88	0.202	10.32	6.4
			3.0	13.41	0.202	10.39	6.37
ST-2	**1.0**	**1.0**	**Surface**	14.91	0.204	9.99	6.31
Inlet	**N/A**	**N/A**	**Surface**	11.7	0.215	11.46	6.42

N/A = not applicable

Manalapan Lake

Sample Date **18-Apr-05**

STATION	CHL A (mg/m^3)	SRP	TP	TSS (mg/L)	Alkalinity	Hardness
ST 1 - midlake (near dam)	5.30	0.011	0.030	4.0	5	43.5
ST 1 - Deep (near dam)	--	--	0.070	--	--	--
ST 2 - undredged section	--	--	--	--	--	--
ST 3 - inlet (brook)	--	0.005	0.040	4.0	--	--

Manalapan Lake

Sample Date **27-Jun-05** composited stormwater sample

	mg/L	
STATION	**TP**	**TSS**
ST 3 - inlet (brook)	0.340	27

NOTES:	**Amount**	**Station ID**	**Station Name**
Rainfall for 24-hour period	1.20"	286055	New Brunswick 3 SE
	1.56"	283181	Freehold Marlboro
Rainfall for previous 72 hours	Trace	286055	New Brunswick 3 SE
	0.00"	283181	Freehold Marlboro

http://climod.nrcc.cornell.edu

In-Situ Monitoring for Manalapan Lake 14 July 2005							
Station	**DEPTH (meters)**			**Temperature**	**Conductivity**	**Dissolved Oxygen**	**pH**
	Total	**Secchi**	**Sample**	**(^{0}C)**	**(mmhos/cm)**	**(mg/L)**	**(units)**
ST-1	**3.0**	**0.5**	**Surface**	25.43	0.19	10.65	6.32
			1.0	25.22	0.189	10.02	6.52
			2.0	21.67	0.186	5.34	6.2
			3.0	19.95	0.182	1.50	5.96
ST-2	**0.9**	**0.1**	**Surface**	22.82	0.183	7.30	6.04
			0.5	22.69	0.182	6.15	6.04
Inlet	**N/A**	**N/A**	**Surface**	22.62	0.2	8.81	6.38

N/A = not applicable

Manalapan Lake

Sample Date **14-Jul-05**

STATION	mg/m^3 CHL *a*	mg/L SRP	TP	TSS	Alkalinity	Hardness
ST 1 - midlake (near dam) - surface	86.4	0.013	0.030	6	9.0	38.5
ST 1 - midlake (near dam) - deep	--	--	0.250	--	--	--
ST 2 - undredged section	--	--		--	--	--
ST 3 - inlet (brook)	--	0.019	0.190	22	--	--

In-Situ Monitoring for Manalapan Lake 16 Aug 2005								
Station	**DEPTH (meters)**			**Temperature**	**Conductivity**	**Dissolved Oxygen**	**pH**	**Notes**
	Total	**Secchi**	**Sample**	**(^{0}C)**	**(mmhos/cm)**	**(mg/L)**	**(units)**	
ST-1	**3.0**	**1.25**	**Surface**	26.75	0.204	7.94	6.97	overcast; water greenish-brown; culvert near dam under repair (floods in mid-July)
			1.0	26.75	0.204	8.07	6.88	
			2.0	24.03	0.186	3.79	6.11	
			3.0	22.2	0.193	0.97	6.06	
ST-2			**Surface1 (RR)**	26.72	0.215	7.92	6.50	water level too low for boat (2 in situ readings taken offshore); several patches of water lilies; water brownish-green
			Surface2 (upstream)	26.42	0.226	3.49	6.11	
Inlet	**N/A**	**N/A**	**Surface**	22.68	0.257	7.40	6.83	overcast; water brownish-green; flow moderate; stream level low

N/A = not applicable

Manalapan Lake

Sample Date **16-Aug-05**

STATION	mg/m^3 CHL A	mg/L SRP	TP	TSS	Alkalinity	Hardness
ST 1 - midlake (near dam) - surface	10.4	0.003	0.040	5	114	48.50
ST 1 - midlake (near dam) - deep	--	--	0.060	--	--	--
ST 2 - undredged section	--	--	--	--	--	--
ST 3 - inlet (brook)	--	0.009	0.090	< 3	--	--

In-Situ Monitoring for Manalapan Lake 5/2/08							
Station	**DEPTH (meters)**			**Temperature**	**Conductivity**	**Dissolved Oxygen**	**pH**
	Total	**Secchi**	**Sample**	**(^{0}C)**	**(mmhos/cm)**	**(mg/L)**	**(units)**
ST-1	**3.1**	**0.75**	**Surface**	14.7	0.2	9.96	7.94
			1.0	14.01	0.219	9.06	7.71
			2.0	13.37	0.217	8.31	7.5
			3.0	12.41	0.217	6.20	7.43
ST-2	**2.9**	**0.60**	**Surface**	14.6	0.218	9.36	8.06
			1.0	12.2	0.217	9.06	8.05
			2.0	11.83	0.215	2.27	7.86
			2.5	11.8	0.218	2.00	7.47
Inlet	**N/A**	**N/A**	**Surface**	12.81	0.222	8.70	7.7

In-Situ Monitoring for Manalapan Lake 6/19/08							
Station	**DEPTH (meters)**			**Temperature**	**Conductivity**	**Dissolved Oxygen**	**pH**
	Total	**Secchi**	**Sample**	**(^{0}C)**	**(mmhos/cm)**	**(mg/L)**	**(units)**
ST-1	**2.5**	**0.65**	**Surface**	23.60	0.231	5.63	7.20
			1.0	23.12	0.231	5.45	7.10
			2.0	22.79	0.233	3.90	7.02
ST-2	**2.0**	**0.80**	**Surface**	24.43	0.231	6.84	7.53
			1.0	22.21	0.233	6.10	7.35
			2.0	19.37	0.236	5.40	7.31
Inlet	**N/A**	**N/A**	**Surface**	18.07	0.235	6.41	7.72

In-Situ Monitoring for Manalapan Lake 8/1/08							
Station	DEPTH (meters)			Temperature	Conductivity	Dissolved Oxygen	pH
	Total	Secchi	Sample	(^{0}C)	(mmhos/cm)	(mg/L)	(units)
ST-1	2.6	0.75	Surface	26.48	0.178	10.11	7.64
			1.0	25.02	0.183	8.49	7.35
			2.0	23.13	0.166	3.09	6.89
			2.3	22.31	0.159	1.20	6.57
ST-2	2.8	0.80	Surface	27.33	0.181	10.25	8.36
			1.0	26.65	0.183	9.50	7.96
			2.0	22.08	0.167	1.86	7.13
			2.5	21.84	0.173	1.08	6.7
Inlet	N/A	N/A	Surface	23.72	0.218	7.30	7.51

In-Situ Monitoring for Manalapan Lake 8/19/08							
Station	DEPTH (meters)			Temperature	Conductivity	Dissolved Oxygen	pH
	Total	Secchi	Sample	(^{0}C)	(mmhos/cm)	(mg/L)	(units)
ST-1	2.5	0.50	Surface	26.23	0.241	11.84	9.69
			1.0	23.68	0.238	7.21	8.03
			2.0	22.43	0.222	4.10	7.45
			2.5	21.95	0.243	1.57	6.88
ST-2	2.0	0.80	Surface	26.29	0.241	11.84	9.77
			1.0	25.71	0.232	11.28	9.39
			1.5	24.65	0.236	9.27	8.55
Inlet	N/A	N/A	Surface	22.33	0.271	7.89	7.31

Baseline Water Quality Data for
Manalapan Lake, Middlesex County, New Jersey

2-May-08

SAMPLE ID	Chl *a*	SRP	TP	TSS
ST- 1 SURFACE	19.1	0.043	0.05	6
ST-1 DEEP	NS	NS	0.11	NS
INLET	NS	NS	0.04	5

19-Jun-08

SAMPLE ID	Chl *a*	SRP	TP	TSS
ST- 1 SURFACE	6.9	0.023	0.08	5
ST-1 DEEP	NS	NS	0.08	NS
INLET	NS	NS	0.11	10

1-Aug-08

SAMPLE ID	Chl *a*	SRP	TP	TSS
ST- 1 SURFACE	34	0.033	0.09	ND <3
ST-1 DEEP	NS	NS	0.1	NS
INLET	NS	0.073	0.12	ND <3

19-Aug-08

SAMPLE ID	Chl *a*	SRP	TP	TSS
ST- 1 SURFACE	84.9	ND <0.003	0.04	11
ST-1 DEEP	NS	NS	0.06	NS
INLET	NS	NS	0.32	189

NS = not sampled

ND = non-detect

All values are in mg/L except Chl. *a* which is in mg/m^3

Stormwater Water Quality Data from the Inlet of Manalapan Lake, Middlesex County, New Jersey

28-Apr-08

SPL ID	TP	TSS
INLET	0.07	10

23-Jul-08

SPL ID	TP	TSS
INLET	0.08	ND <3

14-Nov-08

SPL ID	TP	TSS
INLET	0.17	25

ND = non-detect

All values are in mg/L

Manalapan Lake Zooplankton/Phytoplankton Community Composition 5/2/2008					
Zooplankton			**Phytoplankton**		
Organism	**Number per Liter**	**µg/L**	**Organism**	**Cells/ml**	**µg/L**
Copepods			*Melosira*	977.4	1790.7
Nauplii	2.3	1.8	**Total**	**977.4**	**1790.7**
Total	**2.3**	**1.8**			
Rotifers			*Synura*	4.5	4.3
Asplanchna	15.2	20.3	*Ochromonas*	26.8	5.8
Keratella	3.5	0.1	**Total**	**31.2**	**10.2**
Kellicottia	1.2	0.1			
Total	**19.9**	**20.5**			
			Cryptomonas	13.4	13.0
Grand Total	**22.2**	**22.3**	**Total**	**13.4**	**13**
			Grand Total	**1022.0**	**1813.9**
Highlighted Rows Indicate Dominant Group					

Manalapan Lake Zooplankton/Phytoplankton Community Composition 6/19/2008					
Zooplankton			**Phytoplankton**		
Organism	**Number per Liter**	**µg/L**	**Organism**	**Cells/ml**	**µg/L**
Cladocera			**Cyanophyta**		
Daphnia	8.93	20.84	*Anabaena*	380.58	907.19
Bosmina	15.30	15.45	**Total**	**380.58**	**907.19**
Ceriodaphnia	1.28	2.25			
Total	**25.50**	**38.54**	**Chlorophtyta**		
			Chlorella	2.48	1.96
Copepods			**Total**	**2.48**	**1.96**
Nauplii	2.55	1.99			
Total	**2.34**	**1.83**	**Bacillariophyta**		
			Stephanodiscus	1.24	6.81
Rotifers			*Melosira*	65.70	120.38
Conochilus	26.78	3.29	**Total**	**66.94**	**127.19**
Total	**24.62**	**3.03**			
			Chrysophyta		
Grand Total	**52.46**	**43.40**	*Chromulina*	29.75	6.98
			Total	**29.75**	**6.98**
			Grand Total	**479.75**	**1043.32**
Highlighted Rows Indicate Dominant Group					

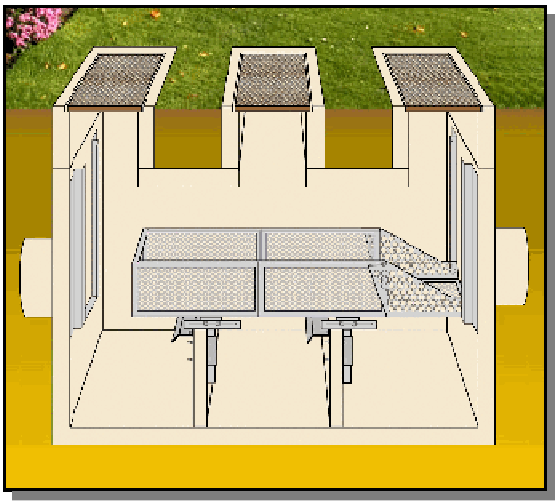
Manalapan Lake Zooplankton/Phytoplankton Community Composition 8/1/2008					
Zooplankton			**Phytoplankton**		
Organism	**Number per Liter**	**µg/L**	**Organism**	**Cells/ml**	**µg/L**
Cladocera			**Bacillariophyta**		
Bosmina	3.6	3.7	*Melosira*	14.4	26
Ceriodaphnia	1.8	3.2	*Fragillaria*	1.9	7.6
Total	**5.5**	**6.9**	**Total**	**16.3**	**34**
Copepods			**Cyanophyta**		
Cyclops	1.8	0.4	*Aphanocapsa*	38.0	2.6
Total	**1.8**	**0.4**	**Total**	**38.0**	**2.6**
Rotifers			**Cryptophyta**		
Conochilus	61.9	7.6	*Cryptomonas*	5.8	5.6
Polyarthra	5.5	5.3	*Rhodomonas*	1.0	0.2
Asplanchna	1.8	2.4	**Total**	**6.8**	**5.8**
Filinia	1.8	0.2			
Total	**71.0**	**15.5**	**Chlorophyta**		
			Chlamydomonas	1.9	0.2
Grand Total	**78.3**	**22.8**	*Gloeocystis*	11.5	6.4
			Total	**13.4**	**6.6**
			Pyrrhophyta		
			Peridinium	1.9	11.3
			Ceratium	1.0	9.0
			Total	**2.9**	**20.3**
			Grand Total	**77.4**	**69**
Highlighted Rows Indicate Dominant Group					

Manalapan Lake Zooplankton/Phytoplankton Community Composition 8/19/2008					
Zooplankton			**Phytoplankton**		
Organism	**Number per Liter**	**µg/L**	**Organism**	**Cells/ml**	**µg/L**
Cladocera			**Cyanophyta**		
Ceriodaphnia	3.8	6.6	*Anabaena*	903.9	2154.6
Diaphanosoma	1.9	2.5	*Microcystis*	283.8	532.5
Total	**5.6**	**9.2**	*Aphanizomenon*	315.3	18.5
			Total	**1503.0**	**2705.5**
Copepods					
Diaptomus	1.9	3.2	**Bacillariophyta**		
Nauplii	3.8	2.9	*Melosira*	178.7	327.4
Total	**5.6**	**6.1**	**Total**	**178.7**	**327.4**
Rotifers			**Pyrrhophyta**		
Filinia	1.9	0.2	*Peridinium*	2.6	15.6
Total	**1.9**	**0.2**	**Total**	**2.6**	**15.6**
Grand Total	**13.2**	**15.5**	**Grand Total**	**1684.3**	**3048.5**
Highlighted Rows Indicate Dominant Group					

Three Chambered Nutrient Separating Baffle Box

Except where otherwise noted, the information presented in this factsheet has been provided by the manufacturer (Suntree Technologies, Inc. www.suntree.com)

Manufactured treatment devices are intended to capture sediments, metals, hydrocarbons, floatables, and/or other pollutants in stormwater runoff before being conveyed to a storm sewer, or waterbody (NJDEP 2004). The Three Chambered Nutrient Separating Baffle Box captures rich vegetation and litter in a filtration screen and allows sediment to settle to the bottom of the structure. Thus, the organic pollutant load is separated from the water. After stormevents, the vegetation and litter dry out. Baffle boxes are concrete or fiberglass structures with a series of settling chambers.



Advantages: (EPA 2001)

- Simple, inexpensive stormwater BMPs that effectively remove sediment and suspended solids.
- Can be retrofitted in existing storm lines.

Disadvantages: (EPA 2001)

- Require significant maintenance to remove accumulated sediment.
- Trash racks may release accumulated trash during high flows.
- Not designed for nutrient removal.

Estimated Costs:
Installation for most pre-cast baffle boxes is between $20,000 and $30,000. The average cost for cleaning a baffle box is $450 (England 1998 as cited in EPA 2001).

Maintenance Requirements:
Baffle boxes need regular maintenance such as routine inspections and cleaning. The frequency of cleaning the baffle boxes depends on the amount of rain and accumulated material. Baffle boxes are cleaned using vacuum trucks and are accessed though manholes.

Ascribed Pollutant Removal Efficiencies:

- TSS reduction: 90% (Suntree) 71% (EPA 2001)
- Total phosphorus removal rate: 38% (EPA 2001)
- Total nitrogen removal rate: N/A

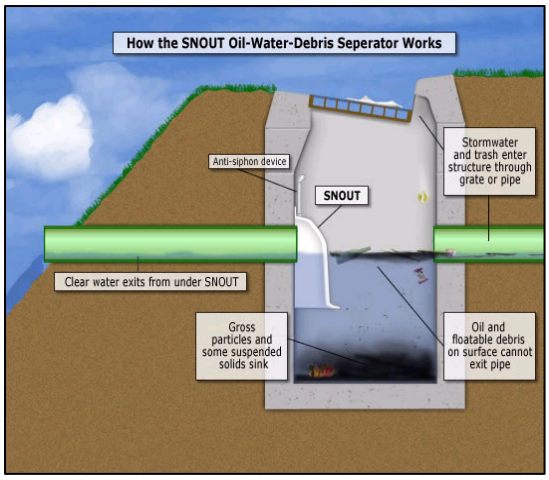
The "SNOUT"

Except where otherwise noted, the information presented in this factsheet has been provided by the manufacturer (Best Management Products, Inc. www.bestmp.com)

The SNOUT is a retrofit device that can be installed within an existing stormwater catch basin to provide stormwater treatment. It consists of a fiberglass hood that fits over the outlet pipe of a sumped catch basin or other water quality structure. The SNOUT can be adapted to filter a variety of difference pollutants, but is primarily used to remove sediment, floatables, and oil from stormwater.

Advantages:

- Low cost compared to other BMPs.
- Easy to install with hand tools.
- Available in a variety of sizes and configurations; optional add-ons available.
- Includes "anti-siphon vent" which prevents surface layer pollutants from flowing downstream under full pipe flows.
- Useful retrofit designed to modify existing stormwater infrastructure.



Source: Best Management Products, Inc.

Disadvantages:

- For larger sites, multiple devices may be necessary.
- May not function as effectively under low flows or in catch basins with shallow sumps.
- Pollutant removal rates have no been verified by PADEP.

Estimated Costs:

The cost for materials to retrofit one catch basin ranges from $200 to over $3,000 (excluding shipping and labor), depending on the size of the catch basin and the number of additional components installed. Material costs for most municipal catch basins would likely range from $400 to $600/ catch basin.

Maintenance Requirements:

Monthly for the first year: Monitor to ensure proper functioning of device.
As needed: Clean out sump when half full (usually requires vacuum truck).
Four times/year and after storm <0.5in.: Inspect device components excepted to receive and/or trap debris for clogging and sediment accumulation; dispose of debris, sediment, and other waste material at suitable disposal/recycling sites and in compliance with applicable waste regulations.
Once/year: Inspect all structural components for cracking, subsidence, and deterioration; flush anti-siphon vent and open/ close access hatch.

Ascribed Pollutant Removal Efficiencies:

- TSS reduction: up to 50%
- Total phosphorus removal rate: mean of 36% (Princeton Hydro, unpublished data for Lake Peekskill, New York).
- Total nitrogen removal rate: no data

Aqua-Swirl

Except where otherwise noted, the information presented in this factsheet has been provided by the manufacturer or representative (AquaShield Stormwater Treatment Solutions http://aquashieldinc.com or Shri Agencies)

The Aqua-Swirl is an effective way to remove sediments, floating debris, and free-oil from stormwater. Both gravitational and hydrodynamic forces allow solids to settle at the bottom of the device. Treated water exits the MTD behind an arched outer baffle. A vent pipe exposes the backside of the baffle to atmospheric conditions; this prevents a siphon from forming at the bottom of the baffle.

The Aqua-Swirl can be shipped fully assembled after leak testing in the factory since the units are light weight.

Advantages:

- The Aqua-Swirl is highly adaptable
- Allows for easy retrofit

Disadvantages:

- No data on phosphorus and nitrogen removal efficiencies.

Estimated Costs:
The cost per unit ranges from $5,300 to $50,000, depending on the size and configuration. Prices are available upon request on a case by case basis.

Maintenance Requirements:
Inspections and maintenance can take place from the surface; free-floating oil and debris can be removed through the service access. It is recommended that inspections are conducted quarterly for the first year of operation in order to determine an appropriate maintenance schedule. Once the usable storage volume is occupied, the accumulated material needs to be removed using a vacuum truck.

Ascribed Pollutant Removal Efficiencies:

- TSS reduction: 80%
- Total phosphorus removal rate: No data
- Total nitrogen removal rate: No data

Aqua-Guardian

Except where otherwise noted, the information presented in this factsheet has been provided by the manufacturer or representative (AquaShield Stormwater Treatment Solutions http://aquashieldinc.com or Shri Agencies)

The Aqua-Guardian (Aqua-Guard) is a catch basin insert that is suspended inside the catch basin by a stainless steel support collar. The collar acts as a funnel to direct stormwater runoff into the sediment collection/ storage area. In addition, the collar traps floatable debris by forming a baffle around the inside of the insert. As water flows through the locked filter screen standpipe it is filtered by media (100% hydrophobic cellulose) that removed fine sediments, nutrients, and heavy metals.

The Aqua-Guard comes in three sizes to fir into the catch basin opening. These inserts are typically used for retrofit applications and can also be used as pretreatment devices before a swirl separator or Aqua-Filter.

Advantages:

- The Aqua-Swirl is highly adaptable.
- Allows for easy retrofit.

Disadvantages:

- No data on pollutant removal efficiencies.

Estimated Costs:
The Aqua-Guard system costs between $1,350 and $2,750 per unit. This price includes shipping.

Maintenance Requirements:
In most cases, the Aqua-Guard MTD should be inspected monthly and after significant storm events. The MTD can be visually inspected from the surface and a tape measure can be used to determine the amount of sediment in the collection area. Once the sediment reaches the bottom "filter screen outlets" the unit needs to be serviced. Servicing is conducted by using a wet/dry shop-vac to remove sediment and debris inside the chamber. The filter bag also needs to bee removed and replaced; sediment in the filter area should be removed prior to inserting a new filter.

Ascribed Pollutant Removal Efficiencies:

- TSS reduction: No data
- Total phosphorus removal rate: No data
- Total nitrogen removal rate: No data

Manufactured treatment devices: CDS Unit and Vortechs Stormwater Treatment System

Except where otherwise noted, the information presented in this factsheet has been provided by the manufacturers, CDS Technologies, Inc. <www.cdstech.com> and Vortechnics, Inc. <www.vortechnics.com>

Manufactured treatment devices (MTDs) are intended to capture sediments, metals, hydrocarbons, floatables, and/or other pollutants in stormwater runoff before being conveyed to a storm sewer system, other stormwater BMP, or waterbody (NJDEP, 2004).

The Continuous Deflective Separation (CDS) Unit is a retrofit device that is installed below-grade within an existing stormwater system. It diverts stormwater from into a containment chamber, where it flows through a screen that filters out pollutants and allows solids to settle out (NJCAT, 2003). The filtered water then flows through the outlet and returns to the stormwater system. The Vortechs Stormwater Treatment System is a similar retrofit device that enhances gravitational separation of materials from stormwater (NJCAT, 2004).

Advantages:

- MTDs are appropriate for small drainage areas with high impervious cover likely to contribute high hydrocarbon and sediment loads (e.g., small parking lots, gas stations) (NJDEP, 2004).
- If designed, installed and maintained properly, both devices have low risk of failure (NJCAT 2003, 2004).
- Both MTDs can trap oil, debris and trash.
- Neither has moving parts or filters to be replaced; Vortechs has 20-year warranty.
- **Useful retrofit**: designed to modify existing or new stormwater infrastructure (catch basins).

Disadvantages:

- MTDs are normally used for pretreatment of runoff before discharging to other, more effective stormwater treatment facilities (NJDEP, 2004).
- **Nutrient removal rates are not verified by NJDEP.**

Source: CDS Technologies, Inc.

- Lack of maintenance may cause these MTDs to operate at reduced efficiency and may eventually lead to system failure (NJCAT 2003, 2004).
- CDS units may <u>export</u> total phosphorus if leaf litter accumulates in the system (NJCAT, 2003).
- Both MTDs hold standing water, which can lead to mosquito breeding if not cleaned out frequently.

Estimated Costs:

USEPA estimates the costs of pre-cast CDS units from $15,700 for a 3 cfs unit to $61,800 for a 26 cfs unit. Equipment costs for the precast units range from $2,377 to $5,233 per cfs treated. Installation costs are site-specific, but typically range from half of to equal to the unit cost (EPA, 2004a). Costs for the Vortechs system begin at approximately $1500 per cfs treated, including manhole frames and covers but not risers (if needed) and installation costs (EPA, 2004b).

Maintenance Requirements:

<u>Four times/year</u>: Monitor to ensure proper functioning; clean out accumulated sediment and debris if needed (typically with a vacuum truck or clamshell bucket).

Once/year: Inspect all structural components for cracking or subsidence. It is also recommended to clean out the system just before the winter salting/sanding season.

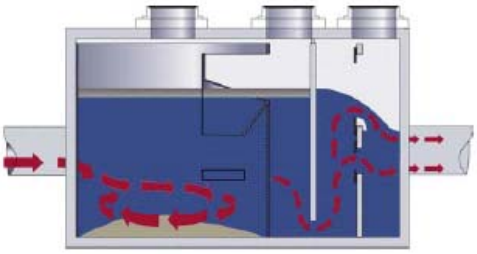
Ascribed Pollutant Removal Efficiencies (estimates provided by manufacturers):

TSS reduction in postconstruction runoff (NJ-verified):
CDS - 68.5% to 87.5%; Vortechs - 64% (NJCAT)

Total phosphorus removal rate (not NJ-verified):
CDS - 30%; Vortechs - 67%

Total nitrogen removal rate (not NJ-verified):
CDS - no data; Vortechs - 18%

Vortechs System



Source: Vortechnics, Inc.

The Case for Re-Considering the Total Phosphorus TMDL for Manalapan Lake

1. ***Low Phosphorus Retention Coefficient***. The Phosphorus Retention Coefficient (R_p) is a measure of the amount of phosphorus that enters a lake on an annual basis and is retained. Typically, lakes and reservoirs with R_p values greater than 0.6 (60%) are prone to algal blooms and nuisance densities of aquatic plants. For example, the R_p for Lake Hopatcong was calculated to be 73%. In contrast, the R_p for Manalapan Lake, using the long-term precipitation database, was calculated to be 11%. In addition, using the 2003 water year data, the R_p for Manalapan Lake was 9%. Given these hydrologic and pollutant loading characteristics, the link between the large external phosphorus load and potential algal blooms is weak in Manalapan Lake.

2. ***Substantial Difference Between Measured and Predicted TP Concentrations***. Based on the limited amount of water quality sampling that was conducted at Manalapan Lake (five sampling events over two years), the mean surface water TP concentration was 0.04 mg/L. If inlet TP concentrations are included, the mean TP concentration is 0.064 mg/L. In contrast, based on the Reckhow model, the mean TP concentration is 0.132 mg/L. Thus, the model severely overestimates the mean TP concentration.

3. ***Appropriateness of the Reckhow Model for Manalapan Lake***. NJDEP selected the Reckhow model to predict steady state in-lake TP concentrations. The Reckhow model is relatively robust and is generally applicable to temperate waterbodies. However, this applicability is limited to those waterbodies that fall within an identified range of in-lake and mean influent TP concentrations, areal water loads and areal TP loads. While the Manalapan Lake values for some of these water quality parameters are within the upper range of the accepted values, they indicate that the Reckhow model is appropriate for Manalapan Lake.

4. ***Non-Algal Turbidity Impacting Water Quality and Clarity***. Using the Carlson's trophic state models for total phosphorus, Secchi depth and chlorophyll *a*, deviations from standard phosphorus – algal relationships can be identified. A graphical illustration of this is provided. Based on this deviation analysis, there tends to be a surplus of phosphorus associated with non-algal particles. This non-algal particles are also frequently responsible for the low water clarity.

5. ***Extremely Large Watershed to Lake Area Ratio***. A variety of factors drive biological productivity in a waterbody and one of these includes the Watershed to Lake Area Ratio. Essentially, as this ratio increases, the magnitude of the nutrient load will increase, with all other watershed characteristics being equal. A Watershed to Lake Area Ratio is considered large when it is 100:1. Manalapan Lake's ratio is 362, which indicates that extremely large reductions in the watershed nutrient loads are required to produce a measurable decline in productivity. The extremely large Watershed to Lake Area Ratio for Manalapan Lake also highlights the complex nets of streams throughout its watershed.

6. ***Environmental and Economic Benefits Relative to Amount of Required Restoration Efforts***. The beach at Manalapan Lake is located in Jamesburg Borough, which accounts for a small portion of the entire watershed. The majority of the watershed is located in Monroe Township, Middlesex County and Manalapan Township, Monmouth County. Relative to the vast majority of the watershed, concentrating on a riparian / streambank protection plan would be more applicable than a phosphorus TMDL-based Restoration Plan for the lake.

7. ***Biological Impacts on In-Lake Water Quality Conditions***. As part of the Manalapan Lake and Watershed Restoration Plan, a fishery survey was conducted in spring of 2005. Based on this survey over 75% of the collected fish were yellow bullhead, a benthic-feeding species that is well known to contribute to increased turbidity.

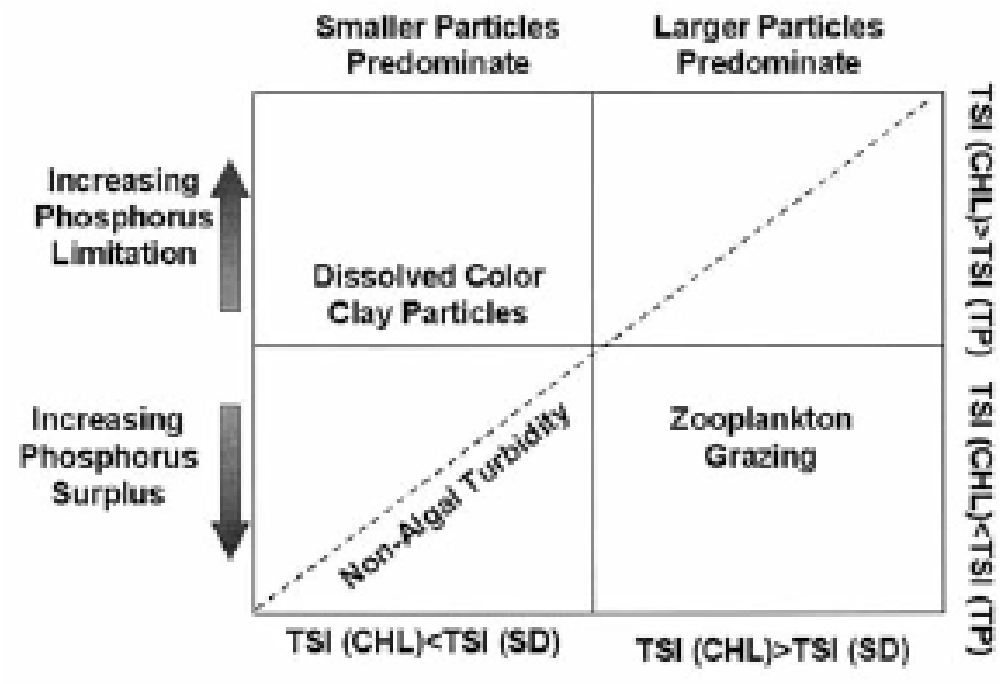
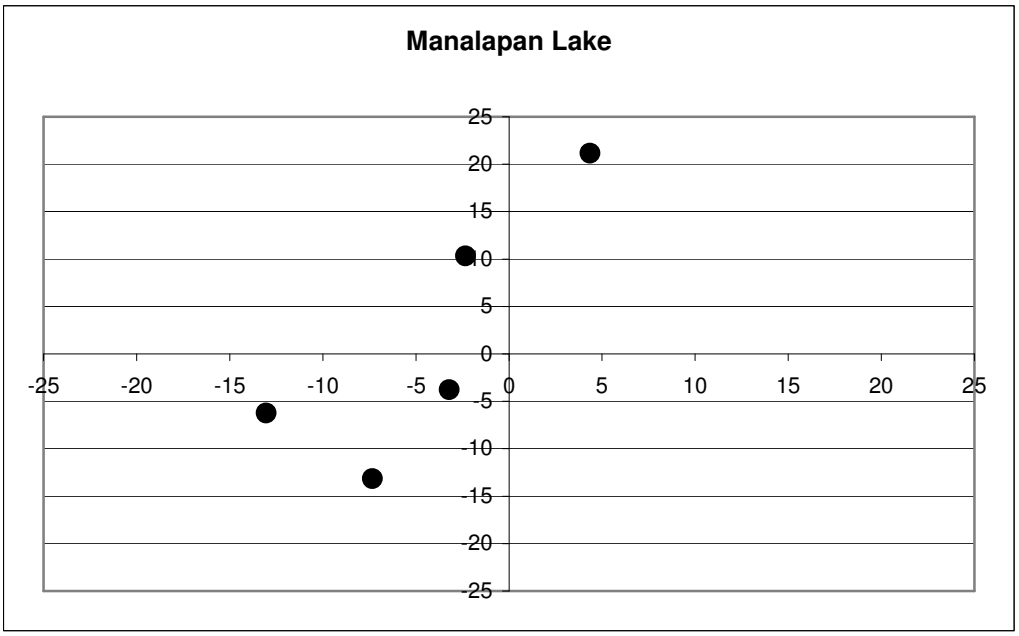
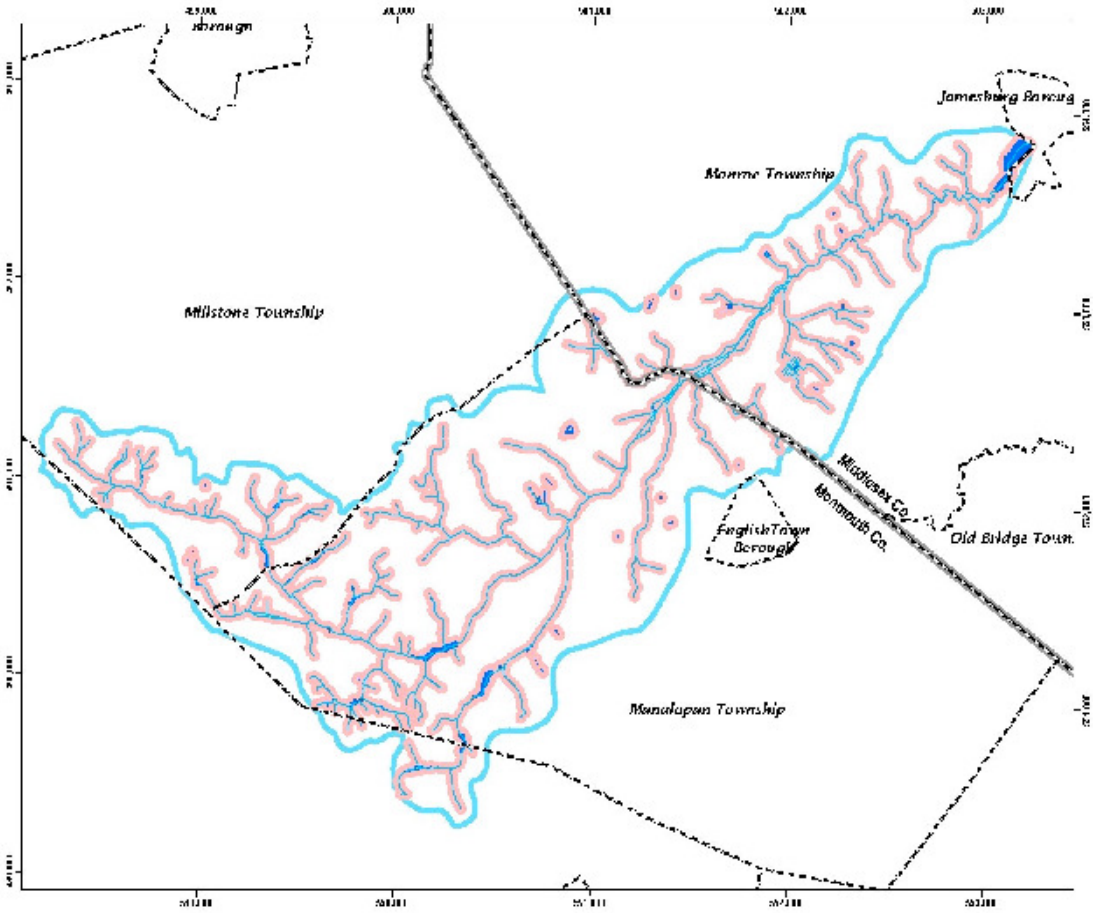


Figure 2.–Possible interpretations of deviations of Trophic State Index (TSI) values of Carlson (1977).




Jamesburg Borough
Monroe Township
Milstone Township
Middlesex Co.
Monmouth Co.
Old Bridge Town.
Borough
Manalapan Township

The Development of a Lake and Watershed Restoration / Implementation Plan for Manalapan Lake

Presented to the Manalapan Lake Watershed Restoration / Implementation Plan Project Committee

By Princeton Hydro, LLC

28 October 2005

Objectives and Strategy of the Project

- Re-assessing the lake and watershed with the completed water quality database (includes additional sampling events conducted in July and August 2005).
- Evaluation of the Manalapan Lake phosphorus TMDL, as developed by NJDEP.

pH

Objectives and Strategy of the Project

- Development of a Restoration / Implementation Plan for Manalapan Lake.
- Prioritization of implementation strategies.

pH

Technical Scope of Work

- Task 7 – Prioritization and assessment of funding sources for implementation.
- Task 8 – Development of final design of work plans for implementation strategies as agreed upon by the project committee and NJDEP.
- Task 9 – Formal presentation on the Manalapan Lake Restoration / Implementation Plan.

pH

pH

Manalapan Lake Phosphorus Budget

Source	kg	Percent
Surface Runoff	4,095	74
Septic Systems	896	16
Internal Loading	57	1
Atmospheric	1.5	< 1
Groundwater	478	9
Total	**5,527**	**100**

pH

Water Quality Modeling

- Reckhow's model is a widely accepted, steady-state model used to predict annual or growing season mean TP concentrations.
- It is the model identified for use in New Jersey's phosphorus TMDLs for lake ecosystems.
- Schindler's model is a robust model that translates TP concentration into algal biomass (chlorophyll *a* concentrations).

pH

Manalapan Lake

Sampling Date	TP (mg/L)	Chl *a* (mg/m^3)
11-Aug-04	0.04	4.0
18-Oct-04	0.02	15.8
18-Apr-05	0.03	5.3
14-Jul-05	0.03	86.4
16-Aug05	0.04	10.4

pH

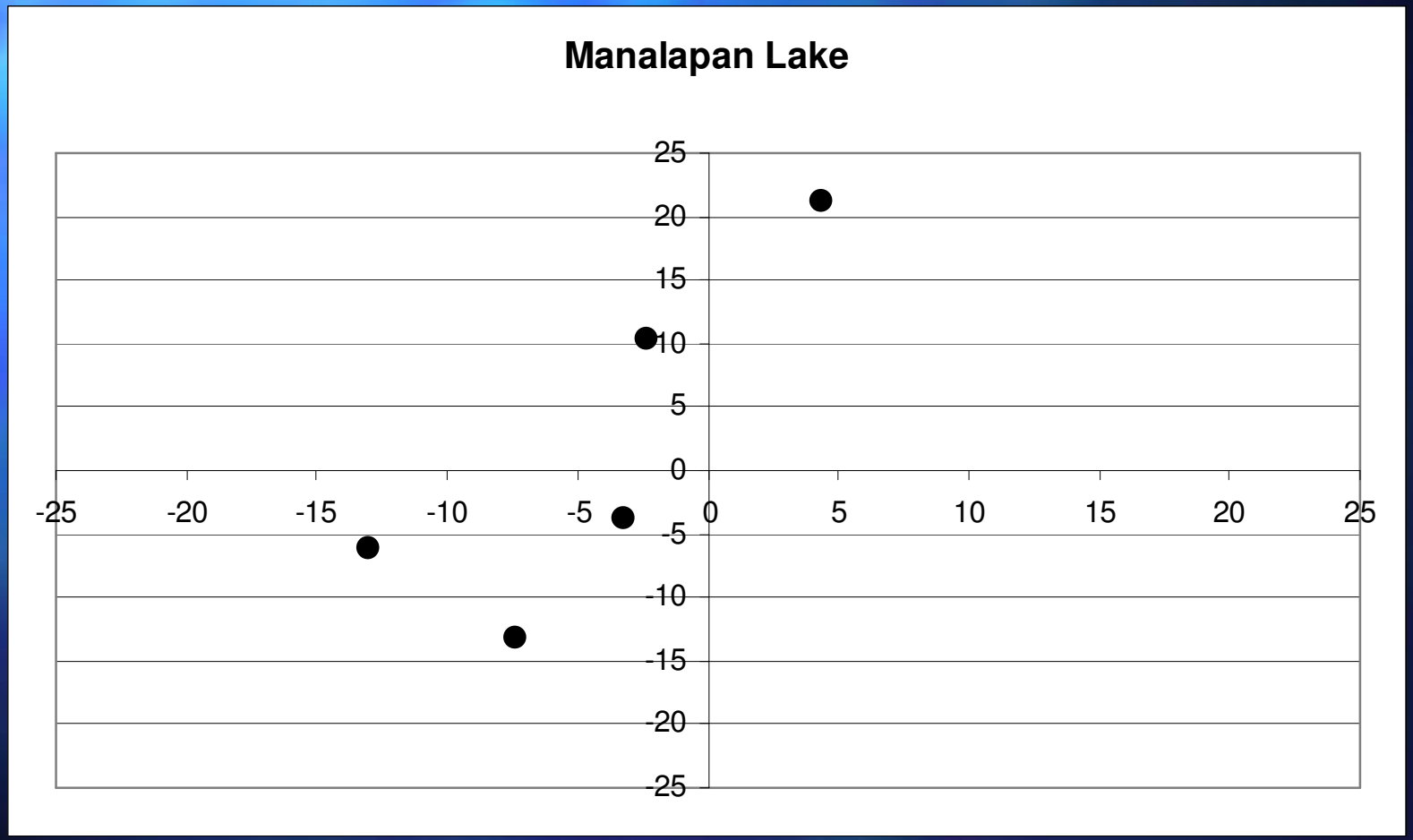
Water Quality Modeling

Scenario	Reckhow TP con.	Schindler Chl. *a*
Existing Conditions	0.132 mg/L	52.8 mg/m^3
Reference Conditions	0.022 mg/L	6.0 mg/m^3
Build-out Conditions	0.162 mg/L	67.8 mg/m^3
Measured Concentrations	0.040 mg/L	26.5 mg/m^3

pH

Water Quality Modeling

Carlson Trophic State Deviation Analysis



pH

pH

pH

pH

Water Quality Modeling

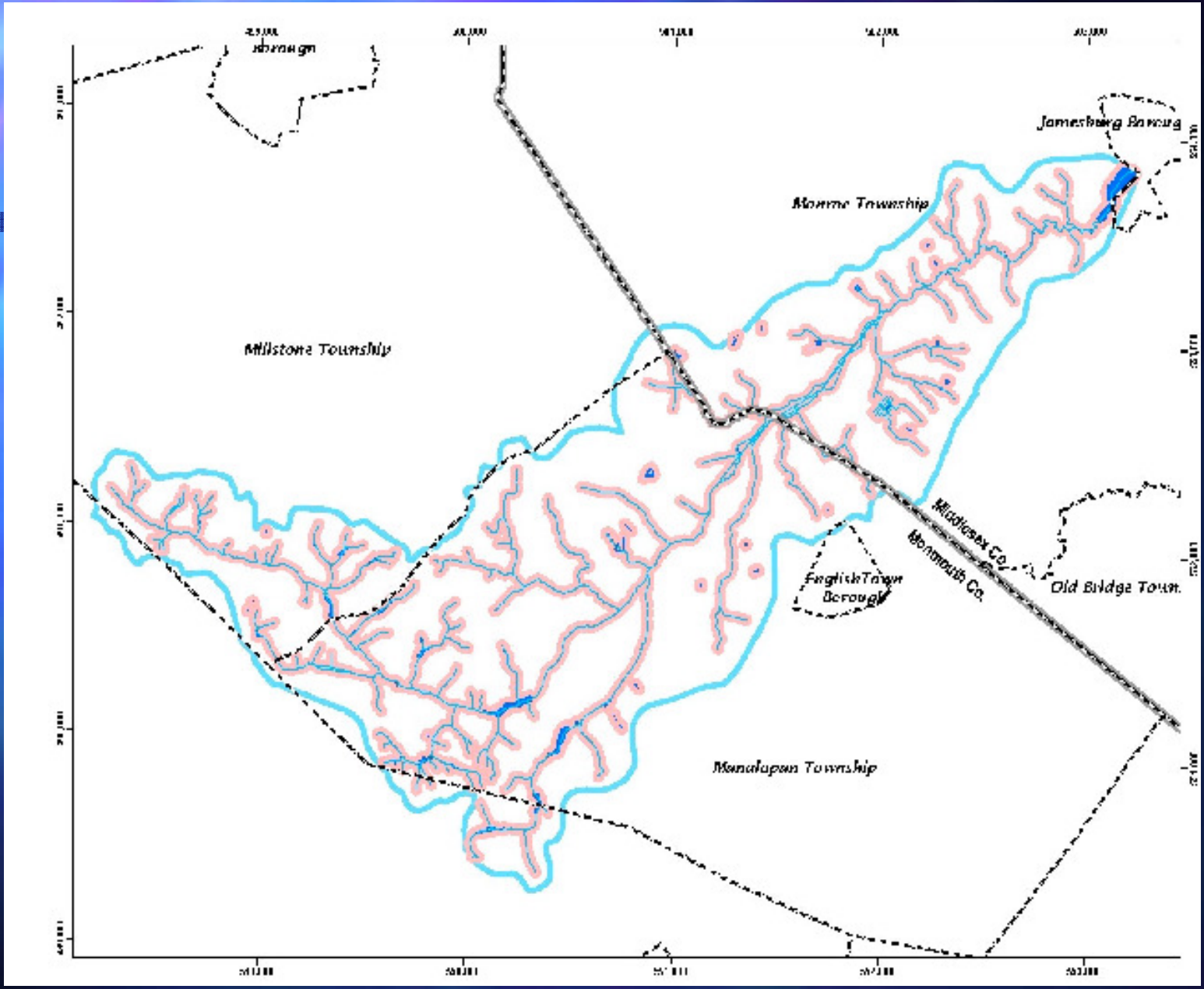
- The mean in-lake TP concentration of 0.04 mg/L is below the targeted concentration of 0.05 mg/L.
- The Reckhow model does not reasonably predict in-lake TP concentrations.
- The TP / chlorophyll *a* relationship is weak in Manalapan Lake.

pH

Surface Runoff P Loads Based on Municipal Boundaries

Municipality	Kg / yr	Percent
Freehold Twhp	306	7.5
Manalapan Twhp	2,349	57.4
Jamesburg Boro	14	0.3
Monroe Twhp	882	21.5
Millstone Twhp	542	13.2
Englishtown Boro	2	> 0.1
Total	**4,095**	**100**

pH


Jamesburg Borough
Monroe Township
Millstone Township
Middlesex Co.
Monmouth Co.
Old Bridge Town.
Manalapan Township

pH

Manalapan Lake Fishery Survey
18 April 2005

SPECIES	TOTAL	
White Sucker	5	
Yellow Bullhead	267	76%
Pumpkinseed	23	
Chain Pickerel	1	
Yellow Perch	5	
Bluegill	19	
American Eel	26	
Largemouth Bass	2	
American Carp	1	
Black Crappie	1	
Golden Shiner	1	
ALL	**351**	

pH

Yellow Bullhead

pH

Largemouth Bass

pH

Manalapan Lake
Restoration / Implementation Plan

- A water quality monitoring program should be implemented on an inter-annual basis.
- Since the TP / chlorophyll *a* relationship is weak and the model predicts substantially higher in-lake TP concentrations, focus on reducing the TSS load.
- In-lake restoration activities should receive a higher ranking.

pH

Proposed Restoration Strategy

- Long-term water quality monitoring.
- In-lake restoration techniques, focusing on the removal of the yellow bullhead and re-structuring the open water food web to favor piscivorous fishes such as largemouth bass.
- The addition of structure for the fishery.
- Elevated fecal coliform or an accumulation of debris along the beach could be addressed through circulation / ozone.

pH

Re-directing the Manalapan Lake Restoration / Implementation Plan

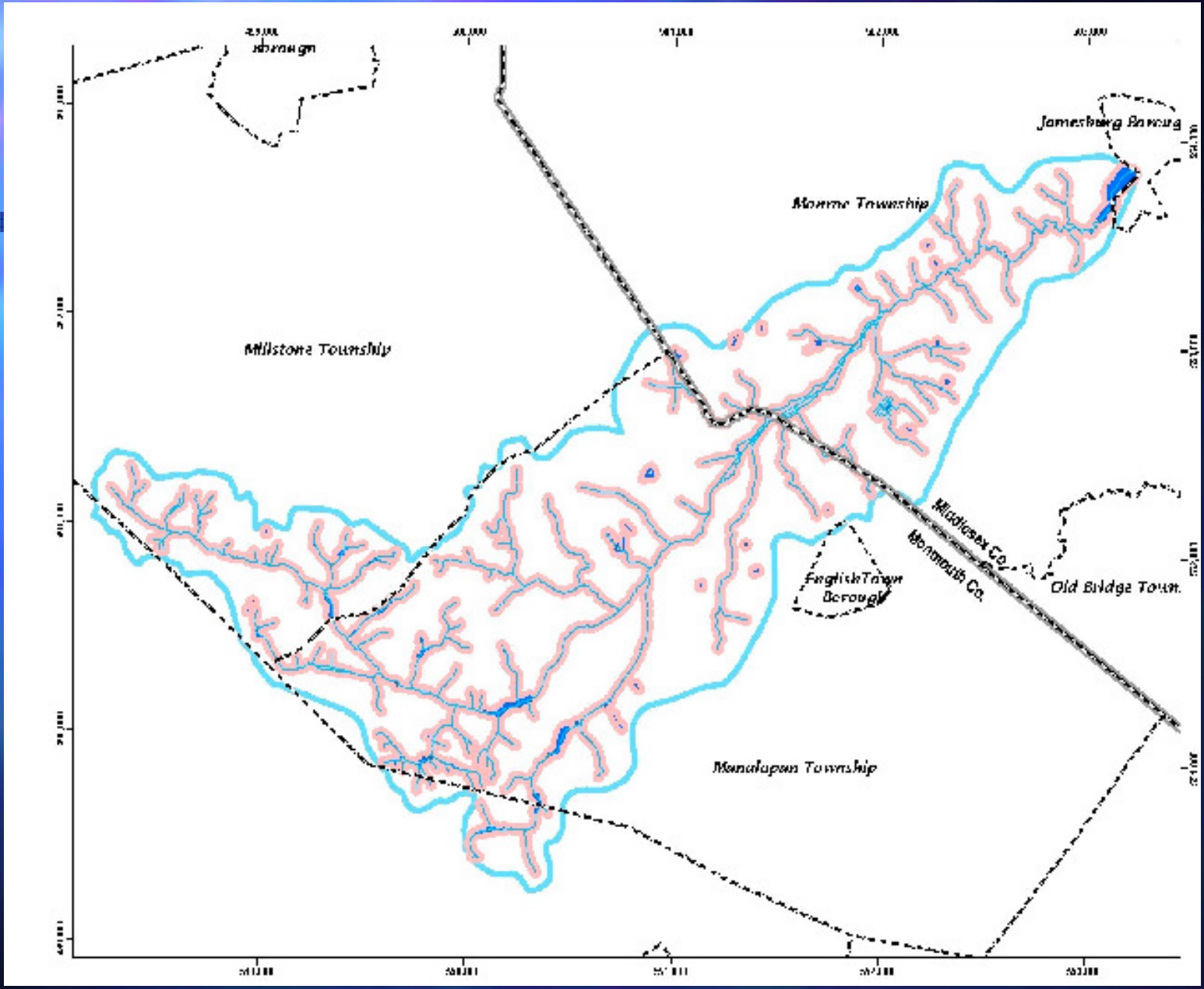
- Make the primary pollutant of concern TSS instead of TP.
- Promote the use of agricultural BMPs on farmland and investigate potential sources of funding.
- Emphasize to municipalities the value of adhering to their MS4 permits.
- Provide information to the municipalities on innovative and certified retrofits.

pH

Re-directing the Manalapan Lake Restoration / Implementation Plan

- Perhaps "re-running" the TP TMDL with a model that takes streambank functions into consideration, such as the ArcView Generalized Watershed Loading Function model (AVGWLF).
- Developing a TMDL for TSS instead of TP.
- Focusing the Plan on stream network throughout the Manalapan Lake watershed.

pH


Jamesburg Borough
Monroe Township
Millstone Township
Middlesex Co.
Monmouth Co.
Old Bridge Town.
Manalapan Township

pH

Shoreline Erosion

pH

Streambank Erosion

pH

Development of Municipal Critical Open Space Maps

- Refine Raritan Basin Council's Water Resources Protection Open Space (WRPOS) model
  - List of criteria to prioritize open space protection
  - Initial criteria were consolidated into 4 GIS coverages of <u>undeveloped</u> areas:
    - Wellhead Protection Areas
    - Ground Water Recharge Rates
    - Riparian Areas
    - T&E Wildlife Species Habitat

pH

WRPOS Model

Elements of the GIS Model for Water Resources Protection

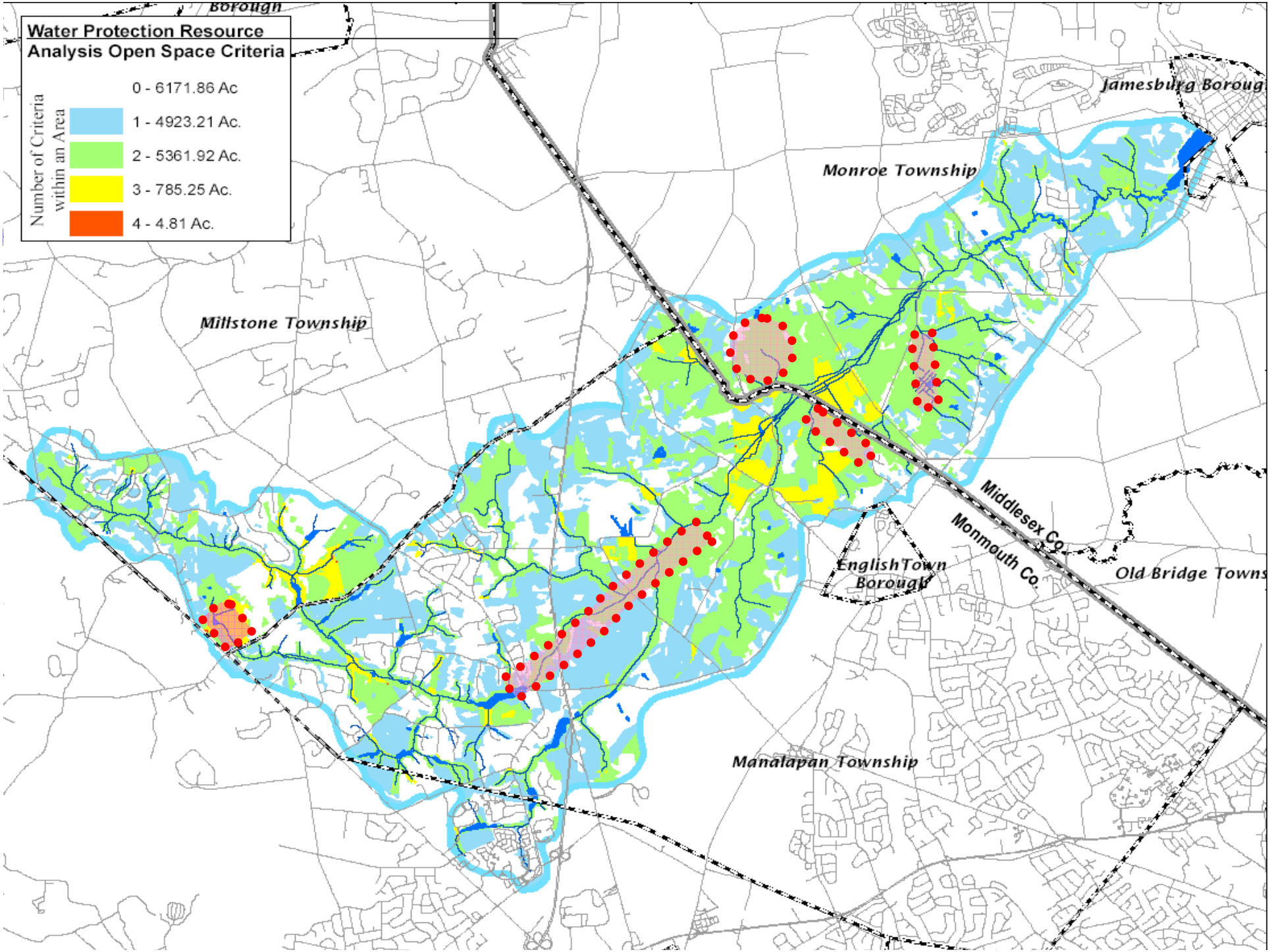
GIS Coverage to be Used	Initial Criterion/Criteria Addressed by Coverage	Protection Area Includes
1. Wellhead Protection Areas (WHPA)	Wellhead Protection Areas (A) Recharge Protection (B)	Undeveloped portions of Tiers 1 & 2
2. **Ground Water Recharge (NJGS GSR-32 calculation)**	Ground Water Recharge (B)	Open spaces within the undeveloped areas of highest recharge rate that comprise 25% of ground water recharge volume for each HUC-11 watershed
3. **Riparian Areas (Raritan Project coverage)**	Headwaters (D); Floodplains (H); Lakes and ponds (G); Wetlands (I); Proximity to Water Body (R); Trout Production Streams (O)	Use complete Raritan Project methodology (Riparian soils, wildlife corridor, 100-yr floodplain, wetlands) for existing riparian areas
4. **Threatened and Endangered Wildlife Species Habitat**	Threatened and Endangered Species (K); Mature Forests (J); Vegetative Cover (P); Wetlands (I)	Emergent wetlands and forested wetlands that protect various categories of T&E species, from NJDEP Landscape Project; plus dense forest area as defined by Spruce Run Initiative
5. **Preserved Open Space**	Preserved Open Space (Determines proximity and linkage of preservation targets to existing, dedicated open space)	All open space identified in Green Acres and NJ Conservation Foundation coverages, plus others as available
6. **Land Use/Land Cover or Percent Impervious Cover**	LU/LC (S); Percent Impervious (T); Vegetative Cover (P)	NJDEP 1995/97 Land Use/Land Cover

pH

Development of Municipal Critical Open Space Maps

- **Municipal info is being used to augment the WRPOS model**
  - WRPOS model coverage is layered over the land use map of the Manalapan Lake watershed to create a "basemap"
  - Each municipality's Master Plan and natural resource inventory documents have been reviewed to identify currently preserved land and specific, targeted open space protection areas (e.g., greenway development, farmland preservation, parkland development, etc.)
  - The identified parcels are being layered on the WRPOS coverage to pinpoint areas of overlap – these areas will be identified as highest priority for preservation

pH


Water Protection Resource
Analysis Open Space Criteria
Number of Criteria within an Area
0 - 6171.86 Ac
1 - 4923.21 Ac.
2 - 5361.92 Ac.
3 - 785.25 Ac.
4 - 4.81 Ac.
Borough
Jamesburg Borough
Monroe Township
Millstone Township
Middlesex Co.
Monmouth Co.
English Town Borough
Old Bridge Towns
Manalapan Township

Development of Municipal Critical Open Space Maps

- **Municipal information is being used to augment the WRPOS model (cont.)**
  - Municipal open space goals described in Master Plans are also being used to identify additional areas of critical open space that will meet local goals <u>and</u> goals of Restoration Plan (e.g., stream corridors)
  - To further prioritize target acquisition areas, refined map will be overlaid on Unit Areal Loading (UAL) map estimating pollutant loads from each municipality

pH

For more information please contact:

Princeton Hydro, LLC
1108 Old York Road, Suite 1, P.O. Box 720
Ringoes, New Jersey 08551
(908) 237-5660
flubnow@princetonhydro.com
ckrupka@princetonhydro.com

THANK YOU

pH

Municipal Open Space Priorities

(Based on a review of municipal Master Plan documents; complete information was not available for all areas)

Municipality	Site Name	Size (acres)	Block/Lot (if known)	WRPOS Criteria	Other features	Access
Manalapan Twp	**Union Hill to the border of Old Bridge Twp (Shade Tree site)**	72	B 3.02 L 37.02, 37.03, 32, 39.02, 31	Uplands, transition areas, wetlands, pond; varied wildlife habitat	Unmarked trails; potential location for park, nature trails, env. ed. center or campground	Elisa Court and drainage easements on Jeanine Ct and Donna Ct
Manalapan Twp	**McBride Rd (Shade Tree Site)**	131.4	B 47 L 24, 46.01	Substantial slopes; mixed vegetation/ wildlife habitat	Overlook of large green area	Exposed sandy soil off McBride Rd
Manalapan Twp	**Rt 9 S, north of Taylor Mills Rd to the Brook (Shade Tree Site)**	18.2	B 10 L 22, 23, 24	Wetlands, transition areas, stream, large trees	Easy accessibility, "welcome break of green" on busy road	Rt 9
Manalapan Twp	**Woodward Rd to Lambs Ln to Smithburg Rd (Shade Tree Site)**	35	unknown	Forest, riparian area, T/E habitat (Swamp Pink)	Open space corridor through residential area	Woodward Rd, Lambs Ln, Smithburg Rd
Manalapan Twp	**Oakland Mills Rd #1 (Shade Tree Site)**	23.2	unknown	Forest, large trees	One of last remaining upland forest stands in this area	Oakland Mills Rd
Manalapan Twp	**Oakland Mills Rd #2, from Oakland Mills Rd to Manalapan Brook (Shade Tree Site)**	20	unknown	Large trees, extension of open space (Manalapan Brook greenway, Thompson Grove Park)	wildlife habitat (wild turkey, raptors)	Oakland Mills Rd
Manalapan Twp	**Millhurst Rd & McCaffery Rd; McCaffery Rd & Rt 527 (Shade Tree Site)**	127; 129	unknown	Forest, wetlands, extension of various open space and riparian areas	variety of wildlife and vegetation	Proposed park on Taylors Mill Rd, Manalapan HS, municipal bldg, post office, Twp recreation center, Loop Trail to Battlefield State Park, proposed school on Millhurst Rd, Manalapan-Englishtown Mdl School

Municipality	Site Name	Size (acres)	Block/Lot (if known)	WRPOS Criteria	Other features	Access
Manalapan Twp	**Manalapan ROW Greenway**	8.9 miles	unknown	Extension of open space (Jamesburg Park, Quail Hill Boy Scout Camp, Knob Hill GC, Charleston Springs Co GC, Turkey Swamp Co Park)	n/a	Jamesburg Park, Quail Hill Boy Scout Camp, Knob Hill GC, Charleston Springs GC, Turkey Swamp Park
Manalapan Twp	**Manalapan Brook Greenway**	7.4 miles	unknown	Extension of open space (proposed Twp park on Smithburg Rd, Thompson Grove Park, Monroe Park)	Would provide intercounty trail, proposed in both Middlesex and Monmouth Co Plans	Charleston Springs Co GC, Thompson Grove Park, Monroe Park
Manalapan Twp	**McGellards Brook Greenway**	7.9 miles	unknown	Riparian area, extension of preserved open space (Monmouth Battlefield State Park, proposed Matchaponix Brook Greenway)	Spurs to the greenway trail link Taylors Mill School, proposed Twp park on Taylors Mill Rd, Manalapan HS, Recreation Ctr	Taylors Mill School, proposed Twp park on Taylors Mill Rd, Manalapan HS, Recreation Ctr
Manalapan Twp	**State plans to create "greenway" of farms and open space linking Washington Crossing State Park, Princeton Battlefield, Monmouth Battlefield State Park**	unknown	unknown	unknown	Will provide access to historic sites, will include trails	unknown
Manalapan Twp	**County plans to create "greenways" across Twp to connect county parks; County Plan shows greenways along Weamaconl Creek, McGellards Brook, Manalapan Brook and Manalapan Utility ROW**	unknown	unknown	unknown	Will connect county parks inside and outside Twp	unknown
Manalapan Twp	**Lafayette Mills Rd Extension**	23	unknown	Extension of preserved Twp open space (Robertsville	Potential for active recreation	along north side of Lafayette Mills Rd

Municipality	Site Name	Size (acres)	Block/Lot (if known)	WRPOS Criteria	Other features	Access
				Rd/Colonial Ct, Lafayette Mills Rd Conservation Area)		
Manalapan Twp	**Taylors Mills Rd**	63.4	unknown	Links two stream corridor greenways/riparian areas (Tephemus Brook, Milford Brook); extension of Loop Trail to Battlefield State Park (public open space)	Potential for active recreation	Utility easement from Gordons Corner Rd
Manalapan Twp	**Manalapan Recreation Ctr Extension**	77.2	unknown	Will create continuous preserved open space corridor from Recreation Ctr to Englishtown	Potential for park development, will preserve views looking south from historic route to Monmouth Battlefield	Twp Recreation Ctr
Manalapan Twp	**Millhurst Rd North**	76.6	unknown	Extension of Loop Trail to Battlefield State Park (public open space)	63% unconstrained by wetlands or housing	Twp Recreation Ctr
Manalapan Twp	**Millhurst Rd South**	50	unknown	Currently farmland, will be preserved as open space	Almost entirely upland, potential for park development close to several residential communities	unknown
Manalapan Twp	**Thompson Grove Park Extension**	27.4	unknown	Extension of Manalapan Brook greenway/riparian area, proposed Twp park, County greenway system (public open space)	5% wetlands	Thompson Grove Park
Manalapan Twp	**Smithburg Rd**	70.6	unknown	Extension of Loop Trail to Battlefield State Park (public open space)	63% unconstrained by wetlands or housing	Twp Recreation Ctr
Freehold Twp	**unknown - open space data requested from Twp**					
Jamesburg Borough	**unknown - existing open space depicted on Master Plan Parks &**					

Municipality	Site Name	Size (acres)	Block/Lot (if known)	WRPOS Criteria	Other features	Access
	Rec Map					
Monroe Twp	**unknown – 958.7 ac of existing preserved farmland depicted on Master Plan map**					
Englishtown Borough	**unknown – data on environmentally critical areas currently in project GIS database**					
Millstone Twp	**Private recreation**	11	B 35 L 19.0	public open space	unknown	unknown
Millstone Twp	**Private recreation**	8.39	B 35 L 17.01	public open space	unknown	unknown
Millstone Twp	**Private recreation**	85.28	B 35 L 2.0	public open space	unknown	unknown
Millstone Twp	**YMCA**	25.82	B 62 L23.0	public open space	unknown	unknown
Millstone Twp	**YMCA**	13.5	B 62 L 24.0	public open space	unknown	unknown
Millstone Twp	**NJDEP**	99.21	B 5 L 1.0	public open space	unknown	unknown
Millstone Twp	**NJDEP**	100.8	B 5 L 2.0	public open space	unknown	unknown
Millstone Twp	**NJDEP**	92.4	B 5 L 4.0	public open space	unknown	unknown
Millstone Twp	**NJDEP**	0.92	B 5 L14.0	public open space	unknown	unknown
Millstone Twp	**NJDEP**	0.92	B 5 L 15.0	public open space	unknown	unknown

Municipality	Site Name	Size (acres)	Block/Lot (if known)	WRPOS Criteria	Other features	Access
Millstone Twp	**NJDEP**	0.92	B 5 L 16.0	public open space	unknown	unknown
Millstone Twp	NJDEP	0.92	B 5 L 17.0	public open space	unknown	unknown
Millstone Twp	NJDEP	10.2	B 2.02 L 1.0	public open space	unknown	unknown
Millstone Twp	NJDEP	115	B 2.02 L 3.0	public open space	unknown	unknown
Millstone Twp	NJDEP	26	B 2.02 L 6.0	public open space	unknown	unknown
Millstone Twp	NJDEP	26.2	B 2.01 L 2.0	public open space	unknown	unknown
Millstone Twp	NJDEP	24	B 2.01 L 3.0	public open space	unknown	unknown
Millstone Twp	NJDEP	7.5	B 5 L 3.01	public open space	unknown	unknown
Millstone Twp	NJDEP	10.8	B 5 L 3.02	public open space	unknown	unknown
Millstone Twp	NJDEP	16.98	B 5 L 13.0	public open space	unknown	unknown
Millstone Twp	NJDEP	88.28	B 6 L 5.0	public open space	unknown	unknown
Millstone Twp	NJDEP	35.6	B 6 L 6.01	public open space	unknown	unknown
Millstone Twp	NJDEP	22.61	B 2.02 L 2.0	public open space	unknown	unknown
Millstone Twp	JCP&L	0.3	B 2.01 L 1.02	public open space	unknown	unknown
Millstone Twp	JCP&L	0.5	B 1.01 L 1.01	public open space	unknown	unknown
Millstone Twp	NJDEP	8.5	B 2.01	public open space	unknown	unknown

Municipality	Site Name	Size (acres)	Block/Lot (if known)	WRPOS Criteria	Other features	Access
			L 1.0			
Millstone Twp	NJDEP	1	B 2.01 L 1.01	public open space	unknown	unknown
Millstone Twp	NJDEP	13.59	B 1.01 L 1.0	public open space	unknown	unknown
Millstone Twp	NJDEP	1.8	B 1.01 L 1.02	public open space	unknown	unknown
Millstone Twp	NJDEP	24	B 33 L 2.0	public open space	unknown	unknown
Millstone Twp	NJDEP	7.36	B 32 L 1.01	public open space	unknown	unknown
Millstone Twp	NJDEP	65.22	B 32 L 1.02	public open space	unknown	unknown
Millstone Twp	NJDEP	31.34	B 32 L 17.0	public open space	unknown	unknown
Millstone Twp	NJDEP	6.12	B 33 L 3.0	public open space	unknown	unknown
Millstone Twp	NJDEP	63.32	B 32 L 2.0	public open space	unknown	unknown
Millstone Twp	NJDEP	9.35	B 32 L 16.0	public open space	unknown	unknown
Millstone Twp	NJDEP	5.2	B 34 L 1.0	public open space	unknown	unknown
Millstone Twp	NJDEP	13.5	B 32 L 15.0	public open space	unknown	unknown
Millstone Twp	NJDEP	24.4	B 34 L 2.01	public open space	unknown	unknown
Millstone Twp	NJDEP	8.27	B 32 L 13.01	public open space	unknown	unknown
Millstone Twp	NJDEP	6.24	B 32 L 19.0	public open space	unknown	unknown
Millstone Twp	NJDEP	41.49	B 32	public open space	unknown	unknown

Municipality	Site Name	Size (acres)	Block/Lot (if known)	WRPOS Criteria	Other features	Access
			L 12.01			
Millstone Twp	NJDEP	4.72	B 32 L 18.0	public open space	unknown	unknown
Millstone Twp	NJDEP	4.62	B 32 L 14.0	public open space	unknown	unknown
Millstone Twp	NJDEP	1.5	B 34 L 2.02	public open space	unknown	unknown
Millstone Twp	NJDEP	7.9	B 32 L 13.03	public open space	unknown	unknown
Millstone Twp	NJDEP	2.3	B 32 L 13.02	public open space	unknown	unknown
Millstone Twp	NJDEP	1.2	B 32 L 2.02	public open space	unknown	unknown
Millstone Twp	NJDEP	12.44	B 32 L 9.0	public open space	unknown	unknown
Millstone Twp	NJDEP	10.65	B 32 L 12.0	public open space	unknown	unknown
Millstone Twp	NJDEP	12.9	B 34 L 3.01	public open space	unknown	unknown
Millstone Twp	NJDEP	11.54	B 32 L 6.0	public open space	unknown	unknown
Millstone Twp	NJDEP	62	B 34 L 19.0	public open space	unknown	unknown
Millstone Twp	NJDEP	1.5	B 32 L 3.0	public open space	unknown	unknown
Millstone Twp	NJDEP	25.3	B 32 L 4.0	public open space	unknown	unknown
Millstone Twp	NJDEP	12.3	B 34 L 3.02	public open space	unknown	unknown
Millstone Twp	NJDEP	100.6	B 34 L 18.01	public open space	unknown	unknown
Millstone Twp	no data available	no data	B 34	public open space	unknown	unknown

Municipality	Site Name	Size (acres)	Block/Lot (if known)	WRPOS Criteria	Other features	Access
		available	L 4.01			
Millstone Twp	NJDEP	2.43	B 34 L 4.02	public open space	unknown	unknown
Millstone Twp	NJDEP	4	B 34 L 4.03	public open space	unknown	unknown
Millstone Twp	NJDEP	11	B 32 L 5.0	public open space	unknown	unknown
Millstone Twp	NJDEP	42.54	B 34 L 5.0	public open space	unknown	unknown
Millstone Twp	Silkemp Concrete	1.35	B 32 L 12.02	public open space	unknown	unknown
Millstone Twp	NJDEP	5.16	B 32 L 10.0	public open space	unknown	unknown
Millstone Twp	NJDEP	33.38	B 34 L 6.0	public open space	unknown	unknown
Millstone Twp	NJDEP	1	B 32 L 7.0	public open space	unknown	unknown
Millstone Twp	NJDEP	1.54	B 34 L 7.01	public open space	unknown	unknown
Millstone Twp	NJDEP	.92	B 34 L 7.02	public open space	unknown	unknown
Millstone Twp	NJDEP	64.17	B 34 L 15.01	public open space	unknown	unknown
Millstone Twp	NJDEP	0.92	B 34 L 7.03	public open space	unknown	unknown
Millstone Twp	NJDEP	59.57	B 34 L 7.04	public open space	unknown	unknown
Millstone Twp	NJDEP	33.2	B 34 L 17.01	public open space	unknown	unknown
Millstone Twp	NJDEP	2.83	B 34 L 14.01	public open space	unknown	unknown

Municipality	Site Name	Size (acres)	Block/Lot (if known)	WRPOS Criteria	Other features	Access
Millstone Twp	NJDEP	12.6	B 32 L 11.0	public open space	unknown	unknown
Millstone Twp	NJDEP	1	B 32 L 2.01	public open space	unknown	unknown
Millstone Twp	F - Millstone Twp.	2	B 44 L 4.01 (farmlot 38.26)	public open space	unknown	unknown
Millstone Twp	F - Millstone Twp.	2	B 46 L 11.0 (farmlot 51.88)	public open space	unknown	unknown
Millstone Twp	Millstone Twp.	19.2	B 46 L 5.0	public open space	unknown	unknown
Millstone Twp	Millstone Twp.	1	B 51 L 11.0	public open space	unknown	unknown
Millstone Twp	Millstone Twp.	34.22	B 52 L 6.01	public open space	unknown	unknown
Millstone Twp	F - Millstone Twp.	2	B 64 L 3.0 (farmlot 43.77)	public open space	unknown	unknown

MANALAPAN BROOK
WATERSHED PROTECTION AND RESTORATION PLAN
DEMONSTRATION PROJECT

AT THOMPSON PARK,
MONROE TOWNSHIP AND JAMESBURG BOROUGH
BLOCK 59, LOTS 2.02 & 3
MIDDLESEX COUNTY, NEW JERSEY

GENERAL NOTES:

1. ALL ELEVATIONS AND QUANTITIES ARE BASED ON IN-SITU CONDITIONS. ONCE DISTURBED, MATERIAL CONDITIONS CAN VARY SIGNIFICANTLY.

2. THE APPROVAL AND USE OF THESE PLANS ARE FOR THE PROJECT OWNER AS DEPICTED ON THIS SHEET. THIS PLAN IS NOT TO BE UTILIZED IN THE PREPARATION OF ANY OTHER PROJECTS.

3. AS FIELD CONDITIONS MAY REQUIRE MODIFICATIONS TO PROPOSED TOPOGRAPHIC ELEVATIONS AND FACILITY LOCATIONS, THESE PLANS ARE NOT TO BE UTILIZED FOR AS-BUILTS OR FOR PURPOSED OTHER THAN STATED HEREIN.

4. THESE PLANS ARE NOT TO BE UTILIZED FOR CONSTRUCTION, UNTIL ALL REQUIRED LOCAL, STATE, AND FEDERAL PERMITS ARE OBTAINED.

CONSTRUCTION NOTES:

1. SOIL, ROCK, OR OTHER MATERIALS TO BE UTILIZED FOR FILLING OR BACKFILLING SHALL BE APPROVED BY A QUALIFIED GEOTECHNICAL ENGINEER.

2. ALL MATERIALS SHALL CONFORM TO THE LATEST AMERICAN STANDARDS FOR TESTING AND MATERIALS SPECIFICATIONS (ASTM).

3. PROXIMITY OF STOCKPILES TO THE EDGE OF EXCAVATIONS SHALL BE SUCH THAT THE INFLUENCE OF THE STOCKPILE SURCHARGE ON THE MODIFIED OR EXISTING SLOPE IS REDUCED. WHERE POSSIBLE STOCKPILES WILL BE PLACED A DISTANCE FROM THE EDGE OF EXCAVATION EQUAL TO (OR GREATER THAN) THE HEIGHT OF THE EXCAVATION.

4. ALL STOCKPILED MATERIAL PROPOSED FOR USE WILL BE PROTECTED FROM EXCESSIVE LOSS OR GAIN OF MOISTURE USING SECURELY ANCHORED PLASTIC COVERS OR EQUIVALENT METHODS.

5. UTILITIES SHALL BE LOCATED BY THE CONTRACTOR PRIOR TO CONSTRUCTION.

6. NECESSARY PRECAUTIONS SHALL BE TAKEN BY THE CONTRACTOR TO PROTECT EXISTING SERVICES AND MAINS. ANY DAMAGE TO EXISTING SERVICES OR MAINS SHALL BE REPAIRED IMMEDIATELY AT THE CONTRACTORS EXPENSE.

7. EXCAVATIONS AND STOCKPILES IN NO WAY SHALL HAVE SLOPES STEEPER THAN 2:1.

8. THE CONTRACTOR SHALL NOTE THAT IN THE CASE OF A DISCREPANCY BETWEEN THE SCALED AND THE FIGURED DIMENSIONS SHOWN ON THESE PLANS, THE FIGURED DIMENSIONS SHALL APPLY.

9. IT SHALL BE DISTINCTLY UNDERSTOOD THAT FAILURE TO MENTION SPECIFICALLY ANY WORK THAT WOULD NORMALLY BE REQUIRED TO COMPLETE THE PROJECT, SHALL NOT RELIEVE THE CONTRACTOR OF RESPONSIBILITY TO PERFORM THE WORK.

10. IT SHALL BE THE CONTRACTORS RESPONSIBILITY TO ASSURE THE ACCURACY OF THE PROPERTY BOUNDARIES.

11. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE REPAIR AND REPLACEMENT OF PROPERTY DAMAGE TO FENCES, SIGNS, STRUCTURES, VEGETATION, IRRIGATION, LANDSCAPING COMPONENTS, AND ANY OTHER PROPERTY ITEMS THAT ARE REMOVED FOR THE PURPOSES OF THE PROJECT LOGISTICS AND ACCIDENTS.

12. EXISTING ASPHALT SURFACES SHALL REMAIN UNDISTURBED EXCEPT FOR THE PROPOSED WORK AS CALLED FOR ON THESE PLANS. ANY DAMAGE TO THESE ASPHALT SURFACES SHALL BE THE SOLE RESPONSIBILITY OF THE CONTRACTOR AND ALL COSTS FOR REPAIRS SHALL BE BORNE BY THE CONTRACTOR.

13. THE CONTRACTOR SHALL PROVIDE NECESSARY MAINTENANCE AND PROTECTION OF TRAFFIC MEASURES. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO PROVIDE TRAFFIC CONTROL FOR THE ADJACENT PARKING LOT AREA. THE PARKING LOT SHOULD NOT BE CLOSED TO THE PUBLIC AT ANY TIME.

CONSTRUCTION SAFETY AND SECURITY:

1. ALL CONSTRUCTION SHALL ADHERE TO OSHA STANDARDS AND REGULATIONS.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PURCHASE AND INSTALLATION OF HIGH VISIBILITY FENCING TO BE PLACED ALONG THE PROJECT PERIMETER WARNING SIGNS SHALL ALSO BE PROVIDED.
3. THE CONTRACTOR SHALL PROVIDE CONSTRUCTION WARNING SIGNS AND TRAFFIC CONTROL AS REQUIRED BY THE NJ DEPARTMENT OF TRANSPORTATION WITH REGARD TO ACCESS OF CONSTRUCTION VEHICLES AND TRUCKS UTILIZING MUNICIPAL OF STATE ROADWAYS.

PROJECT OWNER:

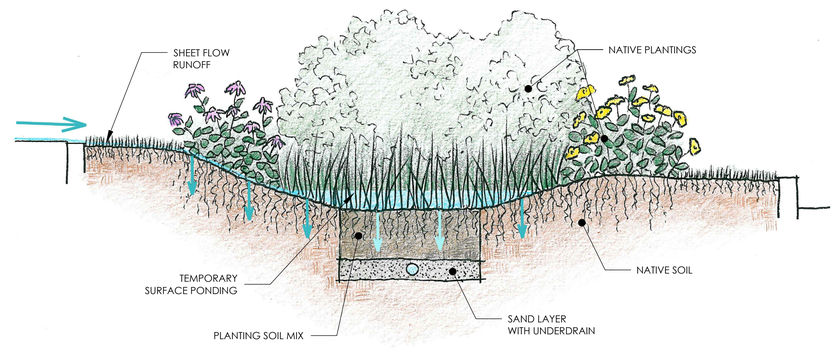
MIDDLESEX COUNTY
DEPARTMENT OF PARKS AND RECREATION
1030 RIVER ROAD
P.O. BOX 661
PISCATAWAY, NEW JERSEY 08903

SHEET INDEX:

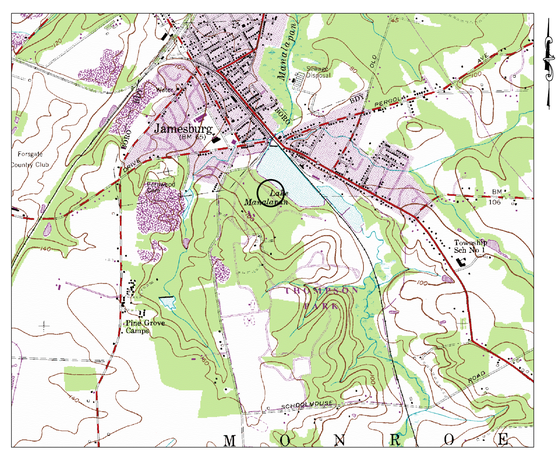
SHEET 1 - TITLE SHEET
SHEET 2 - PROPOSED CONDITIONS
SHEET 3 - PLANTING PLAN AND EROSION AND SEDIMENT CONTROL

PROJECT SUMMARY:

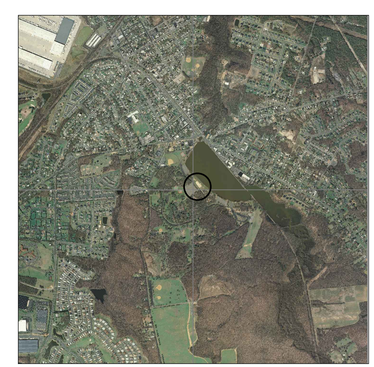
This plan set summarizes the implementation of a demonstration project in support of the Manalapan Brook Watershed Protection and Restoration Plan. The purpose of the demonstration project is to provide Total Suspended Solids (TSS) removal and stormwater control for stormwater runoff entering Manalapan Lake and the Manalapan Brook. More importantly, this project serves as an example to stimulate similar projects throughout the watershed. The Rain Garden collects sheet flow from the adjacent parking lot and temporarily stores water while it is treated and filtered. Runoff that previously flowed into Manalapan Lake untreated will now be controlled by the Rain Garden. The native plantings in the Rain Garden will maintain soil conditions conducive to infiltration and provide evapotranspiration of stored runoff. Runoff will be permitted to infiltrate back into the groundwater while excess flows will be treated prior to being diverted back into the original storm sewer system. The project provides direct water quality and TSS treatment and reduces downstream streambank erosion by controlling the volume and flow rate of runoff.



CONCEPT SCHEMATIC



A PROJECT VICINITY
SCALE: 1" = 2000'
USGS QUADRANGLE
7.5 MINUTE SERIES
JAMESBURG, NEW JERSEY QUADRANGLE



B ORTHOPHOTOGRAPHY
SITE LOCATION
1"=2000'

CALL BEFORE YOU DIG!
NEW JERSEY LAW REQUIRES
3 WORKING DAYS NOTICE FOR CONSTRUCTION PHASE AND 10 WORKING DAYS IN DESIGN STAGE -- STOP CALL
NEW JERSEY ONE CALL SYSTEM, INC.
REFERENCE NEW JERSEY TITLE 48, CHPT. 2, ARTICLE 9
1-800-272-1000

PROJECT NOTES

GENERAL NOTES:

1. EXISTING CONDITIONS SURVEY COMPLETED BY B&B HI TECH, WEST BERLIN, NJ, MARCH 9, 2010.
2. THE HORIZONTAL DATUM IS NORTH AMERICAN DATUM 1983 (NAD83) NEW JERSEY STATE PLANE (FIPS 2900), UNITS OF FEET.
3. THE VERTICAL DATUM IS NATIONAL GEODETIC VERTICAL DATUM 1927 (NGVD29), UNITS OF FEET.

DATE	DESCRIPTION

REVISIONS

STATE OF NEW JERSEY CERTIFICATE OF AUTH. NO.: 24GA27976800

KEITHE J. MERL
Professional Engineer
NJ Lic. No. GE44839

DATE

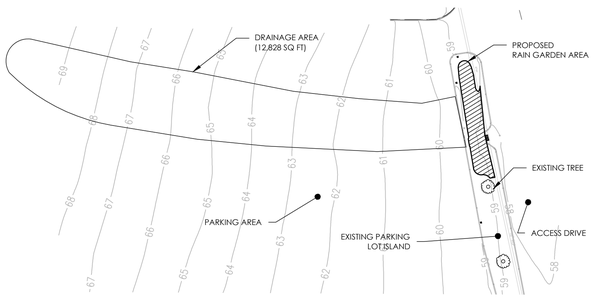
PRINCETON HYDRO, LLC
SCIENTISTS AND ENGINEERS
120 EAST UWCHLAN AVENUE
SUITE 204
EXTON, PENNSYLVANIA 19341
PHONE. 610.524.4220
FAX. 610.514.9434
WWW.PRINCETONHYDRO.COM

PROJECT NAME/LOCATION:
MANALAPAN BROOK
WATERSHED PROTECTION
AND RESTORATION PLAN
DEMONSTRATION PROJECT

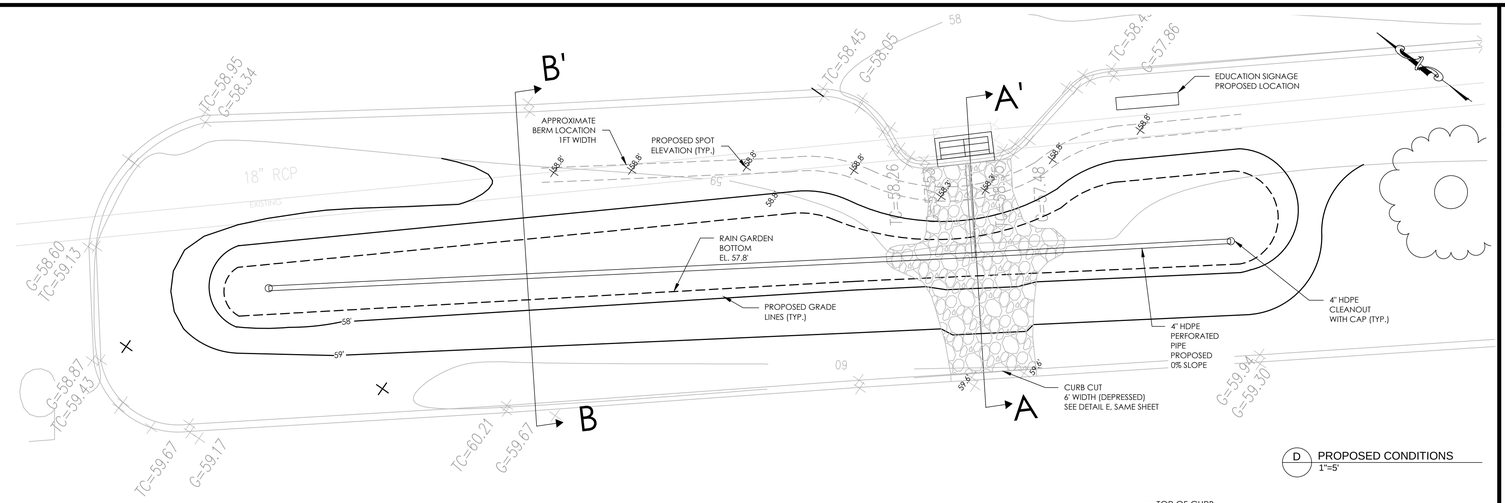
DRAWING NAME:
TITLE SHEET

DATE:	04/12/2010
PROJECT NO.:	0457.008
SCALE:	NOT TO SCALE
DRAWN BY:	JEO
CHECKED BY:	KJM

SHEET NO. 1 OF 3



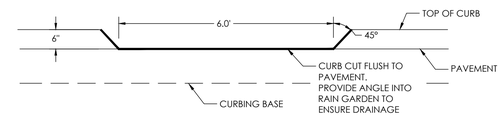
C EXISTING CONDITIONS
1"=60'



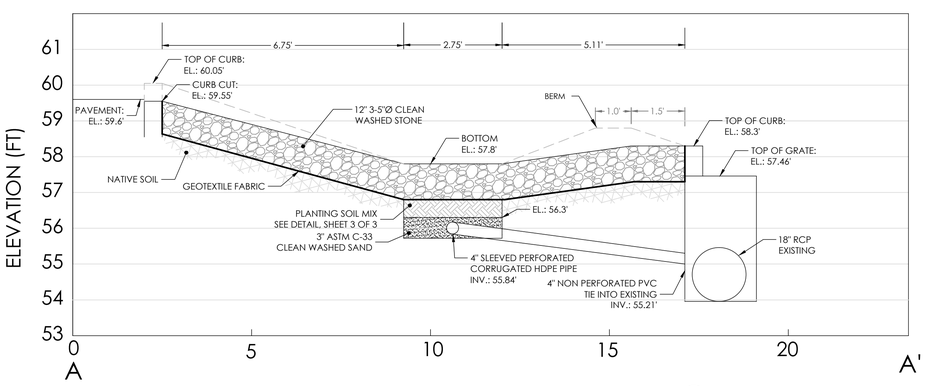
D PROPOSED CONDITIONS
1"=5'

MATERIAL QUANTITIES

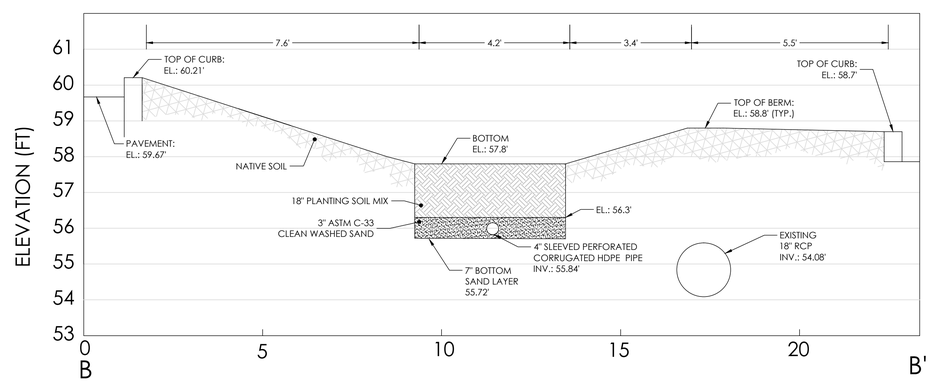
• ASTM C-33 CLEAN WASHED SAND	7 CY
• PLANTING SOIL MIX	17 CY
• FILTER FABRIC	150 SF
• 4" SLEEVED PERFORATED CORRUGATED HDPE PIPE	80 LF
• 4" NON-PERFORATED SCH 40 PVC	10 LF
• MISCELLANEOUS 4" PVC FITTINGS	
• TOP SOIL	15 CY



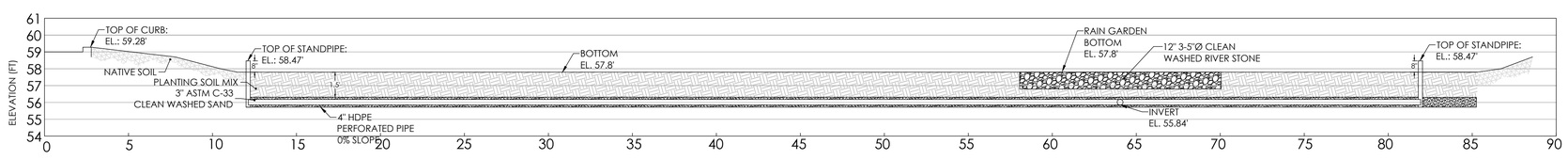
E CURB CUT DETAIL
NOT TO SCALE



1 PROPOSED CROSS SECTION A-A'
1" = 2' H:V



2 PROPOSED CROSS SECTION B-B'
1" = 2' H:V



3 PROFILE ALONG PIPE
1" = 5'

CALL BEFORE YOU DIG!
NEW JERSEY LAW REQUIRES
3 WORKING DAYS NOTICE FOR
CONSTRUCTION PHASE AND 10 WORKING
DAYS IN DESIGN STAGE -- STOP CALL
NEW JERSEY ONE CALL SYSTEM, INC.
REFERENCE NEW JERSEY TITLE 48, CHPT. 2, ARTICLE 9
1-800-272-1000

PROJECT NOTES

GENERAL NOTES:

1. EXISTING CONDITIONS SURVEY COMPLETED BY B&B HI TECH, WEST BERLIN, NJ, MARCH 9, 2010.
2. THE HORIZONTAL DATUM IS NORTH AMERICAN DATUM 1983 (NAD83) NEW JERSEY STATE PLANE (FIPS 2900), UNITS OF FEET.
3. THE VERTICAL DATUM IS NATIONAL GEODETIC VERTICAL DATUM 1927 (NGVD29), UNITS OF FEET.

DATE	DESCRIPTION

REVISIONS

STATE OF NEW JERSEY CERTIFICATE OF AUTH.
NO.: 24GA27976800

KEITHE J. MERL
Professional Engineer
NJ Lic. No. GE44839

DATE

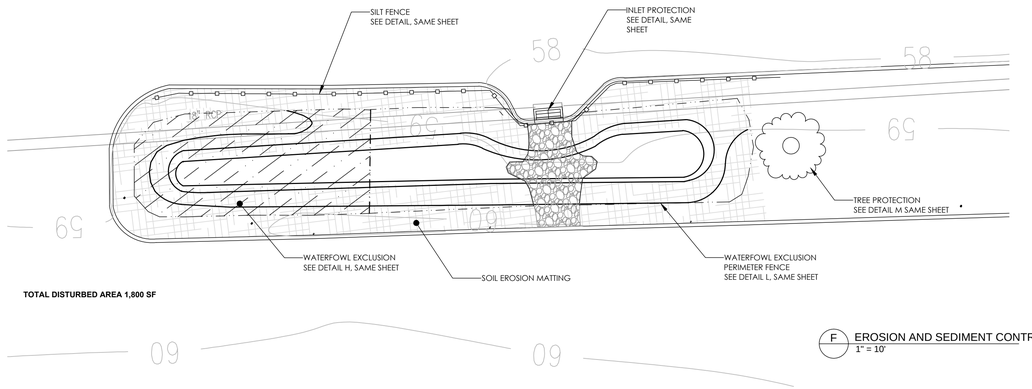
PRINCETON HYDRO, LLC
SCIENTISTS AND ENGINEERS
120 EAST UWCHLAN AVENUE
SUITE 204
EXTON, PENNSYLVANIA 19341
PHONE. 610.524.4220
FAX. 610.514.9434
WWW.PRINCETONHYDRO.COM

PROJECT NAME/LOCATION:
MANALAPAN BROOK
WATERSHED PROTECTION
AND RESTORATION PLAN
DEMONSTRATION PROJECT

DRAWING NAME:
PROPOSED CONDITIONS

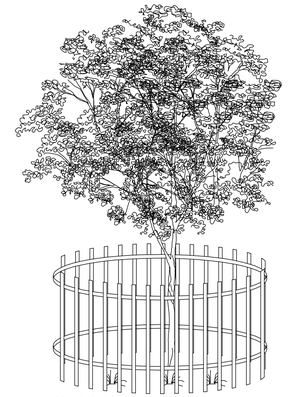
DATE:	04/12/10
PROJECT NO.:	0457.008
SCALE:	AS SHOWN
DRAWN BY:	JEO
CHECKED BY:	KJM

SHEET NO.
2 OF 3



TOTAL DISTURBED AREA 1,800 SF

F EROSION AND SEDIMENT CONTROL PLAN
1" = 10'



M TREE PROTECTION DETAIL
NOT TO SCALE

NOTES:

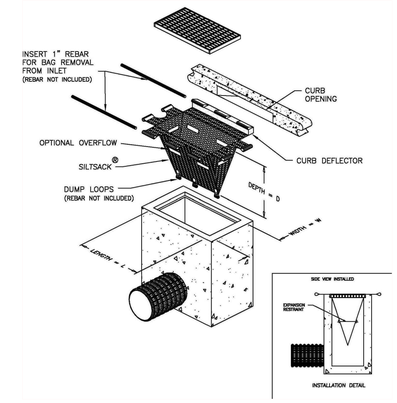
1. TO PREVENT GENERAL MECHANICAL DAMAGE TO TREES INSTALL TREE PROTECTION AROUND ALL GROUPS OF TREES TO REMAIN.

2. BOX TREES WITHIN 25 FEET OF BUILDINGS SITE TO PREVENT MECHANICAL INJURY. FENCING OR OTHER BARRIER SHOULD BE INSTALLED AT THE DRIP LINE OF THE TREE BRANCHES OR BEYOND. TREE ROOT SYSTEMS COMMONLY EXTEND WELL BEYOND THE DRIP LINE.

3. BOARDS WILL NOT BE NAILED TO TREES DURING CONSTRUCTION.

4. FEEDER ROOTS SHOULD NOT BE CUT IN AN AREA INSIDE THE DRIP LINE OF THE TREE BRANCHES.

5. DAMAGED TRUNKS OR EXPOSED ROOTS SHOULD HAVE DAMAGED BARK REMOVED IMMEDIATELY AND NO PAINT SHALL BE APPLIED. EXPOSED ROOTS SHOULD BE COVERED WITH TOPSOIL IMMEDIATELY AFTER EXCAVATION IS COMPLETE. ROOTS SHALL BE PRUNED TO GIVE A CLEAN, SHARP SURFACE AMENABLE TO HEALING. ROOTS EXPOSED DURING HOT WEATHER SHOULD BE IRRIGATED TO PREVENT PERMANENT TREE INJURY. CARE FOR SERIOUS INJURY SHOULD BE PRESCRIBED BY A PROFESSIONAL FORESTER OR CERTIFIED TREE EXPERT.



I INLET SEDIMENT CONTROL DEVICE
NOT TO SCALE
AS MANUFACTURED BY ACF ENVIRONMENTAL, INC

FREEHOLD SOIL EROSION AND SEDIMENT CONTROL NOTES

1. PROJECT TO BE COMPLETED IN ACCORDANCE WITH THE STATE STANDARDS FOR SOIL EROSION AND SEDIMENT CONTROL OF NEW JERSEY.

2. ALL SOIL EROSION AND SEDIMENT CONTROL PRACTICES ARE TO BE INSTALLED PRIOR TO ANY MAJOR SOIL DISTURBANCE, OR IN THEIR PROPER SEQUENCE, AND MAINTAINED UNTIL PERMANENT PROTECTION IS ESTABLISHED.

3. ANY DISTURBED AREAS THAT WILL BE LEFT EXPOSED MORE THAN THIRTY (30) DAYS, AND NOT SUBJECT TO CONSTRUCTION TRAFFIC, WILL IMMEDIATELY RECEIVE A TEMPORARY SEEDING. IF THE SEASON PREVENTS THE ESTABLISHMENT OF TEMPORARY COVER, THE DISTURBED AREAS WILL BE MULCHED WITH STRAW, OR EQUIVALENT MATERIAL, AT A RATE OF 2 TO 2 1/2 TONS PER ACRE, ACCORDING TO STATE STANDARD FOR STABILIZATION WITH MULCH ONLY. IMMEDIATELY FOLLOWING INITIAL DISTURBANCE OR ROUGH GRADING, ALL CRITICAL AREAS SUBJECT TO EROSION (I.E. STEEP SLOPES AND ROADWAY EMBANKMENTS) WILL RECEIVE TEMPORARY SEEDING IN COMBINATION WITH STRAW MULCH OR A SUITABLE EQUIVALENT, AT A RATE OF 1 1/2 TO 2 TONS PER ACRE, ACCORDING TO STATE STANDARDS.

4. ALL SOIL WASHED, DROPPED, SPILLED, OR TRACKED OUTSIDE THE LIMIT OF DISTURBANCE OR ONTO PUBLIC PAVEMENT WILL BE REMOVED IMMEDIATELY.

5. PERMANENT VEGETATION IS TO BE SEEDED OR SODDED ON ALL EXPOSED AREAS WITHIN TEN (10) DAYS AFTER FINAL GRADING.

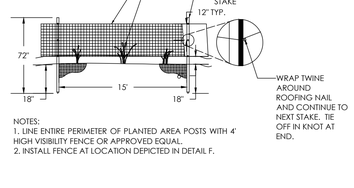
6. AT THE TIME THAT SITE PREPARATION FOR PERMANENT VEGETATIVE STABILIZATION IS GOING TO BE ACCOMPLISHED, ANY SOIL THAT WILL NOT PROVIDE A SUITABLE ENVIRONMENT TO SUPPORT ADEQUATE VEGETATIVE GROUND COVER SHALL BE REMOVED OR TREATED IN SUCH A WAY THAT IT WILL PERMANENTLY ADJUST THE SOIL CONDITIONS AND RENDER IT SUITABLE FOR VEGETATIVE GROUND COVER. IF THE REMOVAL OR TREATMENT OF THE SOIL WILL NOT PROVIDE SUITABLE CONDITIONS, NON-VEGETATIVE MEANS OF PERMANENT GROUND STABILIZATION WILL HAVE TO BE EMPLOYED.

7. UNFILTERED DEWATERING IS NOT PERMITTED. NECESSARY PRECAUTIONS MUST BE TAKEN DURING ALL DEWATERING OPERATIONS TO MINIMIZE SEDIMENT TRANSFER. ANY DEWATERING METHODS USED MUST BE IN ACCORDANCE WITH THE STANDARD FOR DEWATERING.

8. STOCKPILE AND STAGING LOCATIONS ESTABLISHED IN THE FIELD SHALL BE PLACED WITHIN THE LIMIT OF DISTURBANCE ACCORDING TO THE CERTIFIED PLAN.

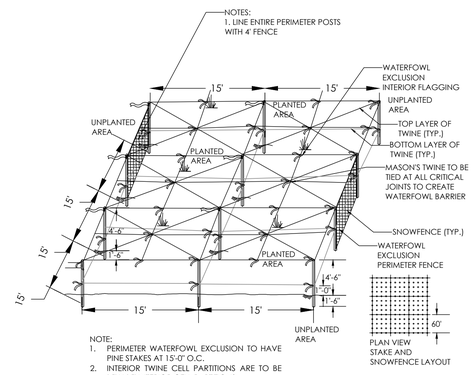
9. ALL SOIL STOCKPILES ARE TO BE TEMPORARILY STABILIZED

10. THE PROPERTY OWNER SHALL BE RESPONSIBLE FOR ANY EROSION OR SEDIMENTATION THAT MAY OCCUR BELOW STORMWATER OUTFALLS OR OFFSITE AS A RESULT OF CONSTRUCTION OF THE PROJECT.



NOTES:
1. LINE ENTIRE PERIMETER OF PLANTED AREA POSTS WITH 4' HIGH VISIBILITY FENCE OR APPROVED EQUAL.
2. INSTALL FENCE AT LOCATION DEPICTED IN DETAIL F.

L TYPICAL WATERFOWL EXCLUSION - PERIMETER FENCING
NOT TO SCALE



NOTE:
1. PERIMETER WATERFOWL EXCLUSION TO HAVE PINE STAKES AT 15'-0" O.C.
2. INTERIOR TWINE CELL PARTITIONS ARE TO BE 15' X 15' INTERIOR CELL PARTITIONS
3. INTERIOR SNOWFENCE CELL PARTITIONS ARE TO BE 60' X 60' INTERIOR CELL PARTITIONS

H TYPICAL WATERFOWL EXCLUSION
NOT TO SCALE

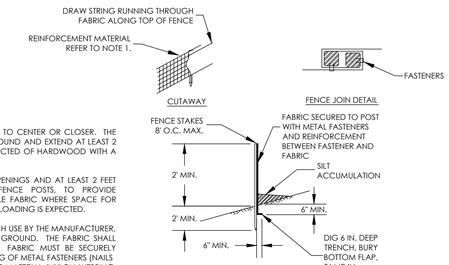
SILT FENCE NOTES:

1. FENCE POSTS SHALL BE SPACED 8 FEET CENTER TO CENTER OR CLOSER. THE POSTS SHALL EXTEND AT LEAST 2 FEET INTO THE GROUND AND EXTEND AT LEAST 2 FEET ABOVE THE GROUND AND SHALL BE CONSTRUCTED OF HARDWOOD WITH A MINIMUM DIAMETER THICKNESS OF 1.5 INCHES.

2. A METAL FENCE WITH 6 INCH OR SMALLER OPENINGS AND AT LEAST 2 FEET HIGH MAY BE UTILIZED. FASTENED TO THE FENCE POSTS, TO PROVIDE REINFORCEMENT AND SUPPORT TO THE GEOTEXTILE FABRIC WHERE SPACE FOR OTHER PRACTICES IS LIMITED AND HEAVY SEDIMENT LOADING IS EXPECTED.

3. A GEOTEXTILE FABRIC, RECOMMENDED FOR SUCH USE BY THE MANUFACTURER, SHALL BE BURIED AT LEAST 4 INCHES DEEP IN THE GROUND. THE FABRIC SHALL EXTEND AT LEAST 2 FEET ABOVE THE GROUND. FABRIC MUST BE SECURELY FASTENED TO THE POSTS USING A SYSTEM CONSISTING OF METAL FASTENERS (NAILS OR STAPLES) AND HIGH STRENGTH REINFORCEMENT MATERIAL (NYLON WEBBING, GROMMETS, WASHERS, ETC.) PLACED BETWEEN THE FASTENER AND THE GEOTEXTILE FABRIC. THE FASTENING SYSTEM SHALL RESIST TEARING AWAY FROM THE POST. THE FABRIC SHALL INCORPORATE A DRAWSTRING IN THE TOP PORTION OF THE FENCE FOR ADDED STRENGTH.

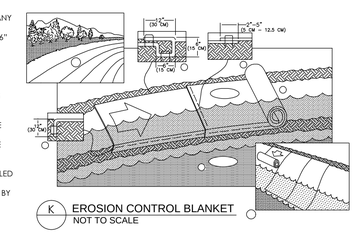
4. SEDIMENTS SHALL BE REMOVED WHEN THE ACCUMULATION HEIGHT REACHES ONE QUARTER THE GROUND HEIGHT OF THE FENCE.



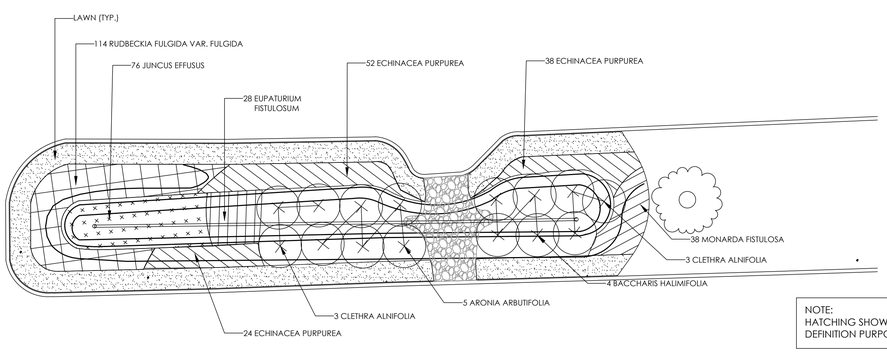
J SILT FENCE DETAIL
NOT TO SCALE

EROSION CONTROL BLANKET (COIR MAT 400 OR APPROVED EQUAL) NOTES:

1. PREPARE SOIL BEFORE INSTALLING EROSION CONTROL BLANKETS (ECB'S) INCLUDING ANY NECESSARY APPLICATION OF LIME, FERTILIZER, STRAW AND SEED.
2. BEGIN AT THE TOP OF THE AREA BY ANCHORING THE BLANKET IN A 6" (15 CM) DEEP X 6" (15 CM) WIDE TRENCH WITH APPROXIMATELY 12" (30 CM) OF EXTENDED BEYOND THE UP-SLOPE PORTION OF THE TRENCH. ANCHOR THE BLANKET WITH A ROW OF STAPLES/STAKES APPROXIMATELY 12" (30 CM) APART IN THE BOTTOM OF THE TRENCH, BACKFILL AND COMPACT THE TRENCH AFTER STAPLING. APPLY SEED TO COMPACTED SOIL AND FOLD REMAINING 12" (30 CM) PORTION OF BACK OVER SEED AND COMPACTED SOIL. SECURE OVER COMPACTED SOIL WITH A ROW OF STAPLES/STAKES SPACED APPROXIMATELY 12" (30 CM) APART ACROSS THE WIDTH OF THE BLANKET.
3. ROLL ECB'S EITHER (A) DOWN THE SHORELINE FOR LONG BANKS, (TO BOTTOM) OR (B) HORIZONTALLY ACROSS THE SHORELINE SLOPE. ECB'S WILL UNROLL WITH APPROPRIATE SIDE AGAINST THE SOIL SURFACE. ALL ECB'S MUST BE SECURELY FASTENED TO SOIL SURFACE BY PLACING STAPLES/STAKES IN APPROPRIATE LOCATIONS AS SHOWN IN THE STAPLE PATTERN GUIDE.
4. THE EDGES OF ALL HORIZONTAL AND VERTICAL SEAMS MUST BE STAPLED WITH APPROXIMATELY 2"-5" (5CM - 12.5 CM) OVERLAP. SEAM OVERLAP SHOULD BE SHINGLED ACCORDING TO PREDOMINANT EROSIVE ACTION.
5. THE EDGE OF THE BLANKET AT OR BELOW NORMAL WATER LEVEL MUST BE ANCHORED BY PLACING THE STAPLES/STAKES IN A 12" (30 CM) DEEP X 6" (15 CM) WIDE ANCHOR TRENCH. ANCHOR THE BLANKET WITH A ROW OF STAPLES/ STAKES SPACED APPROXIMATELY 12" (30 CM) APART IN THE TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING (STONE OR SOIL MAY BE USED AS BACKFILL)
6. IN LOOSE SOIL CONDITIONS, THE USE OF STAPLE OR STAKE LENGTHS GREATER THAN 6" (15 CM) MAY BE NECESSARY TO PROPERLY ANCHOR THE ECB'S



K EROSION CONTROL BLANKET
NOT TO SCALE



NOTE:
HATCHING SHOWN IS FOR BED DEFINITION PURPOSES ONLY.

PLANTING SOIL MIX
PLANTING SOIL MIX SHOULD CONSIST OF 85 TO 95% SAND AND NO MORE THAN 5% CLAY. PLANTING SOIL MIX SHOULD BE LOOSELY PLACED AND NOT COMPACTED.

COMPOST
APPLY 3" LOOSE COARSE LEAF COMPOST TO ALL PLANTING AREAS EXCLUDING LAWN AREAS AND INCORPORATE TO DEPTH OF +/- 12 INCHES

MULCH
TWO (2) INCHES OF DOUBLE-SHREDDED HARDWOOD MULCH TO BE APPLIED TO ALL PLANTED AREAS EXCLUDING LAWN AREAS.

DEEP LANDSCAPE PLUGS
DEEP LANDSCAPE PLUGS TO MEASURE A MINIMUM OF 2.25 x 2.25 x 5 INCHES DEEP. TO BE PLANTED 18 INCHES ON CENTER IN GRID CONFIGURATION FACILITATE FUTURE SEDIMENT REMOVAL BETWEEN PLANTS, IF NECESSARY.

SPECIES NAME:	BOTANICAL NAME:	TYPE OF PLANT MATERIAL:	QUANTITY:
ECHINACEA PURPUREA	PURPLE CONEFLOWER	DEEP PLUG	114
EUPATORIUM FISTULOSUM	JOE PYE WEED	DEEP PLUG	28
JUNCUS EFFUSUS	SOFT RUSH	DEEP PLUG	76
MONARDA FISTULOSA	WILD BERGAMOT	DEEP PLUG	38
RUDBECKIA FULGIDA VAR. FULGIDA	ORANGE CONEFLOWER	DEEP PLUG	114

SHRUBS
PLANTING LAYOUT AS SHOWN IN PLANTING PLAN (DETAIL G).

SPECIES NAME:	BOTANICAL NAME:	TYPE OF PLANT MATERIAL:	QUANTITY:
ARONIA ARBUTIFOLIA	RED CHOKEBERRY	4 GALLON CONTAINER	5
BACCHARIS HALIMIFOLIA	GROUNDSEL TREE	1 GALLON CONTAINER	4
CLETHRA ALNIFOLIA	SUMMERSWEET	7 GALLON CONTAINER	6

LAWN SEED
APPLY 5" LOOSE TOPSOIL, PREPARE/RAKE TOP SOIL AND APPLY SEED STRAW AND ECB.

SPECIES NAME:	BOTANICAL NAME:	APPROXIMATE RATE (LBS PURE SEED/ACRE):
AGROSTIS PERENNANS	AUTUMN BENTGRASS	15
BOUTELOUA GRACILIS	BLUE GRAMA	3
FESTUCA RUBRA	RED FESCUE	8

G PLANTING PLAN
1" = 10'

MATERIAL QUANTITIES

- SILT SACK INLET PROTECTION — 1 EA
- ECB AND STAPLES — 160 SY
- STRAW BALES — 5 EA
- TWINE — 1 EA
- STAKES — 40 EA
- WATERFOWL FENCING — 242 LF
- SILT FENCE — 100 LF
- FLAGGING — 1 EA

CONSTRUCTION SEQUENCE	DAYS
1. INSTALL TEMPORARY SOIL EROSION AND SEDIMENT CONTROL MEASURES	0.5
2. ROUGH GRADE AREA AND CONSTRUCT BERM, EXCAVATE SOIL FOR PLACEMENT OF PIPE	3.5
3. INSTALL PIPE, PLANTING SOIL MIX, TOPSOIL AND FINE GRADE AREA	2
4. INCORPORATE COMPOST, PLANT AND INSTALL WATERFOWL EXCLUSION DEVICES	1
TOTAL DURATION	7 DAYS

CALL BEFORE YOU DIG!
NEW JERSEY LAW REQUIRES
3 WORKING DAYS NOTICE FOR
CONSTRUCTION PHASE AND 10 WORKING
DAYS IN DESIGN STAGE -- STOP CALL
NEW JERSEY ONE CALL SYSTEM, INC.
REFERENCE NEW JERSEY TITLE 48, CHPT. 2, ARTICLE 9
1-800-272-1000

PROJECT NOTES

GENERAL NOTES:

1. EXISTING CONDITIONS SURVEY COMPLETED BY B&B HI TECH, WEST BERLIN, NJ, MARCH 9, 2010.
2. THE HORIZONTAL DATUM IS NORTH AMERICAN DATUM 1983 (NAD83) NEW JERSEY STATE PLANE (FIPS 2900), UNITS OF FEET.
3. THE VERTICAL DATUM IS NATIONAL GEODETIC VERTICAL DATUM 1927 (NGVD29), UNITS OF FEET.

DATE	DESCRIPTION

REVISIONS

STATE OF NEW JERSEY CERTIFICATE OF AUTH. NO.: 24GA27976800

KEITHE J. MERL
Professional Engineer
NJ Lic. No. GE44839

DATE

PRINCETON HYDRO, LLC
SCIENTISTS AND ENGINEERS
120 EAST UWCHLAN AVENUE
SUITE 204
EXTON, PENNSYLVANIA 19341
PHONE. 610.524.4220
FAX. 610.615.9434
WWW.PRINCETONHYDRO.COM

PROJECT NAME/LOCATION:
MANALAPAN BROOK
WATERSHED PROTECTION
AND RESTORATION PLAN
DEMONSTRATION PROJECT

DRAWING NAME:
EROSION AND SEDIMENT CONTROL
AND
PLANTING PLAN

DATE:	04/12/2010
PROJECT NO.:	0457.008
SCALE:	NOT TO SCALE
DRAWN BY:	JEO
CHECKED BY:	KJM

SHEET NO. 3 OF 3

OPERATION AND MAINTENANCE PLAN FOR THE DEMONSTRATION PROJECTS AT THOMPSON PARK STATION #37 MONROE TOWNSHIP

Middlesex County, New Jersey

Prepared for:

New Jersey Water Supply Authority
on behalf of the Manalapan Brook Watershed
Restoration and Protection Plan Project Committee
Watershed Protection Programs
74 East Main Street
Somerville, New Jersey 08876-2312
(P) 908.685.0315 • (F) 908.685.0195
Email: khale@raritanbasin.org

Prepared by:

Princeton Hydro, LLC

120 East Uwchlan Avenue, Suite 204
Exton, Pennsylvania 19341
(P) 610.524.4220 • (F) 610.524.9434
Email: flubnow@princetonhydro.com

February 2011

Introduction and Project Descriptions

The purpose of this Operation and Maintenance (O&M) manual is to describe the necessary maintenance procedures that are required to ensure the continued operation of the rain garden and shoreline re-vegetation. This document should be kept on file at the Thompson Park maintenance facility so that Department of Parks and Recreation employees can readily access the document and become familiar with the specific maintenance requirements of the projects.

The demonstration project included the design and construction of a rain garden and the implementation of a shoreline re-vegetation project along Manalapan Lake. These projects are summarized below.

The purpose of the rain garden is to collect and treat stormwater runoff from the adjacent parking area. The rain garden both removes pollutants and reduces the total volume of stormwater runoff entering Manalapan Lake and Manalapan Brook. The rain garden has been specifically designed to remove suspended sediment from incoming runoff. The native vegetation in the rain garden provides conditions favorable to the infiltration of stormwater runoff and provides an aesthetic amenity to Park. The native vegetation also provides ecological benefits.

Runoff from a ±13,000 square foot portion of the adjacent parking lot flows along the curb line and into the rain garden via a cut out in the curb. A stone channel coveys the flows from the curb cut to the bottom of the rain garden. The interior and side slopes of the rain garden are densely planted with native vegetation well-suited for the moisture conditions experienced in the rain garden. The interior of the rain garden is dressed with double shredded hardwood mulch. The mulch maintains adequate soil moisture levels between storm events which are necessary to support the vegetation. The stone inflow channel extends to the opposite side of the rain garden. This lowered section of the berm provides a means for overflow into the existing storm sewer system during large storms. The rain garden was installed in April of 2010.

The second phase of the demonstration project entailed the re-vegetation of a portion of the Manalapan Lake shoreline. A section of the shoreline buffer was chosen which was eroding and unstabilized but to such an extent that would stabilization would require grading or the installation of permanent structures. The purpose of this re-vegetation was to stabilize the eroding shoreline and prevent further degradation to the water quality of Manalapan Lake and Manalapan Brook. When fully established, the project will also provide a deterrent to the use of the shoreline and adjacent turf area by Canada geese. The re-vegetation project will also provide aesthetic and ecological benefits to the shoreline of Manalapan Lake.

A 150 foot by 10 foot section (1,500 square feet) of the shoreline buffer was fenced and flagged to temporarily protect the plantings from the heavy winter usage of the lake by

Canada geese. The vegetation planted along the shoreline included pickerel weed, duck potato, and soft stem bulrush, with woody vegetation including river birch, red chokeberry, groundsel tree, sweet pepperbush and northern bayberry. The re-vegetation was completed in October of 2010.

Property Ownership

Thompson Park is owned by Middlesex County. The park is operated by the Middlesex County Department of Parks and Recreation. This portion of the park is located on Block 59, Lot 3 in Monroe Township. All maintenance procedures will be coordinated through Middlesex County in cooperation with the Middlesex County Department of Parks and Recreation.

Rain Garden Maintenance

The activities that may be required to maintain the rain garden are summarized in the following sections.

Inspection

The rain garden should be inspected on a monthly basis and should also be inspected following any significant periods of rainfall (>one inch). Frequent inspection is the key to provide early detection of potential maintenance concerns and thereby minimizing any potential maintenance activities.

Watering

During the initial growing season, summer 2010, the rain garden was frequently watered to promote the initial establishment of the vegetation. This watering should not be required during future growing seasons as the plants will have established a root system to sustain them during periods of drought. Supplemental watering during periods of drought will help maintain the vegetation but will likely not be required for their survival.

Stone

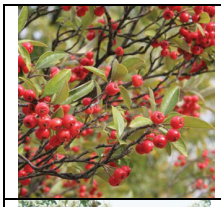
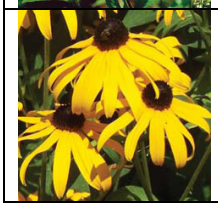
The curb cut out provides inflow conveyance into the rain garden. This section is armored with rounded river stone to protect the underlying soil from the erosive forces of incoming runoff. The same section of stone also provides protection for overflow out of the rain garden along the lake-side curb line. The stone should be maintained in the original area as shown in the design plans. The stones should be inspected to determine if they are being dislodged during periods of inflow. If they are not able to withstand the inflow conditions, they should be replaced with larger material.

Vegetation

The rain garden was planted with native species of vegetation which are ideally suited for the unique conditions in the rain garden. Consequently, the vegetation will not require significant maintenance. The vegetation includes shrubs and perennial types of

vegetation. The plants originally planted in the rain garden are summarized below in Table 1.

Table 1. Summary of native vegetation species planted in the rain garden.

	Red Chokeberry (*Aronia arbutifolia)* Shrub		Scarlet Beebalm *(Monarda didyma)* Perennial
	Groundsel Tree (*Baccharis halimifolia*) Shrub		Eastern Coneflower *(Echinacea purpurea*) Perennial
	Sweet Pepperbush (*Clethra alnifolia)* Shrub		Joe Pye Weed (*Eupatorium fistulosum*) Perennial
	Orange Coneflower (*Rudbeckia fulgida)* Perennial		Soft Rush (*Juncus effusus*) Perennial

The perimeter of the rain garden along the curb lines was planted with turf grass which will require periodic mowing (monthly or more frequently during the growing season). Perimeter areas of the rain garden should be reseeded with seed as necessary to provide full coverage.

The perennial and woody vegetation (shrubs) in the rain garden will not require any fertilization. Dead or damaged branches on the shrubs should be pruned in early spring (March-April). The perennial vegetation in the basin will die back in the fall and winter and grow back the following spring. This dead plant material will provide important seed stock for the continued establishment of vegetation in the basin. The seed stock will also provide an important food source for various birds that may frequent the rain garden in the fall and winter. The dead plant material along with leaves from the shrubs will provide important organic material that will serve to effectively replenish the mulch on annual basis.

Invasive Plants
The rain garden should be monitored for invasive plant species. Based on observations within the watershed this may include Japanese knotweed (*Polygonum cuspidatum*), common reed (*Phragmites australis*), mugwort (*Artemisia vulgaris*), and multiflora rose (*Rosa multiflora*). Frequent monitoring of the project for these and other potential invasive plants during the initial establishment period (1-2 years) will significantly reduce the propensity of the rain garden to become established with these invasive and less-desirable species. Mugwort is expected to be one of the primarily invasive plant concerns for the rain garden due to its presence in the park. If identified it should be carefully removed in a manner that removes the roots system and runners which the plant uses to propagate.

Mulch
During the initial rain garden construction, a layer of triple shredded hardwood mulch was placed in the bottom of the rain garden. If the organic matter produced by the vegetation is not removed from the rain garden, the rain garden should not require the placement of additional triple shredded hardwood mulch on an annual basis.

Sediment
The rain garden is designed to capture sediment. Sediment accumulation in the stone and bottom of the rain garden is expected. This material will likely need to be removed on an annual basis. The removal of sediment should be accomplished by raking the sediment into small piles and removing it with a shovel. The material should be removed from the rain garden and disposed of properly. The removal of the sediment will maintain the original storage capacity of the rain garden and prevent the clogging of the soil surface.

Snow
The placement of snow in the rain garden will typically damage the woody vegetation (shrubs); however this damage will likely not be severe enough to kill the shrubs and will likely just require that the damaged braches be pruned in the spring. Snow which may be stockpiled in the rain garden will melt and continue to be treated by the rain garden.

General Considerations
The rain garden should not be used to for the disposal of leaf debris or grass clipping or any other material. The rain garden should also be monitored to ensure that potential deer browsing is not significantly impacting the vegetation within the rain garden. If deer browsing begins to impact the vegetation, alternative species may need to be considered. Similar to other sections of the park, periodic removal of trash and debris will also be required in the rain garden.

Shoreline Re-Vegetation Maintenance
The activities that may be required to maintain the shoreline re-vegetation project are summarized in the following sections.

Inspection
The shoreline re-vegetation project should be inspected on a weekly basis during the initial establishment period (1-2 years). Frequent inspection is the key to provide early detection of potential maintenance concerns and thereby minimizing any potential maintenance activities.

Waterfowl Exclusion Measures
The planted area was surrounded by goose fencing and twine with flagging. These measures were installed to prevent Canada geese from dislodging plugged vegetation prior to the full establishment of the vegetation. These measures should be kept in place during the first full year of plant establishment (throughout the spring, summer and fall of 2011). At the end of the 2011 growing season the project should be inspected to determine if the vegetation has become substantially established to warrant the removal of the waterfowl exclusion measures. These measures will need to be inspected on a weekly basis to determine if geese are accessing the enclosed area. The fencing my require repair or replacement during this time frame. If portions of the fence require multiple repairs, additional stakes should be used to reinforce the fencing in these weaker sections. Twine and flagging will also require maintenance and replacement on an as-needed basis.

Vegetation
The shoreline was planted with native species of vegetation which are ideally suited for the riparian location along the Manalapan Lake shoreline. Consequently, the vegetation should not require significant maintenance. The vegetation includes trees, shrubs and perennial species of vegetation. The plants originally planted in shoreline re-vegetation are summarized below in Table 2.

Table 2 . Summary of native vegetation species planted in the shoreline re-vegetation.

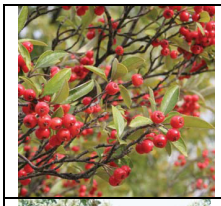
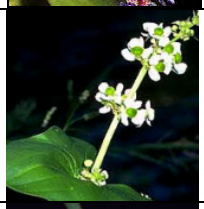
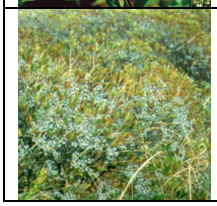
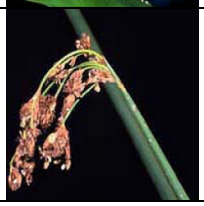
	Red Chokeberry (*Aronia arbutifolia)* Shrub		River Birch *(Betula nigra)* Tree*
	Groundsel Tree (*Baccharis halimifolia*) Shrub		Pickerel Weed *(Pontederia cordata*) Perennial*
	Sweet Pepperbush (*Clethra alnifolia)* Shrub		Duck Potato (*Sagittaria latifolia*) Perennial*
	Northern Bayberry (*Myrica pensylvania)* Shrub*		Softstem Bulrush (*Scripus tabernaemontani*) Perennial*

*Photo courtesy of USDA-NRCS Plants Database

The plants should be inspected at during the spring and summer of 2011 to determine the relative success of the vegetation. If high mortality (>75%) is observed among any of the species, the cause for the insufficient establishment should be determined. Additional vegetation should be planted and other native species should be considered if the cause can not be determined.

Invasive Plants

The shoreline should be monitored for invasive plant species. Based on observations within the watershed this may include Japanese knotweed (*Polygonum cuspidatum*), common reed (*Phragmites australis*), mugwort (*Artemisia vulgaris*), and multiflora rose (*Rosa multiflora*). Frequent monitoring of the project for these and other potential invasive plants during the initial establishment period (1-2 years) will significantly reduce the propensity of the shoreline to become established with these invasive and less-desirable species.

QUALITY ASSURANCE PROJECT PLAN
FOR MANALAPAN LAKE,
MIDDLESEX COUNTY, NEW JESERY

Submitted for the Proposed Scope of Work:
Development of the Manalapan Lake and
Watershed Restoration / Implementation Plan

Submitted to:

New Jersey Water Supply Authority
74 East Main Street
Somerville, New Jersey 08876-2312

and

New Jersey Department of Environmental Protection
Division of Watershed Management
P.O. Box 418
Trenton, New Jersey 08625-0418

Prepared by:

Princeton Hydro, LLC
P.O. Box 720
1108 Old York Road, Suite 1
Ringoes, New Jersey 08551

April 2004
Revision #1 - August 5, 2005 (based on July 2005 Addendum - revisions indicated in bold)

Project Name: Providing Technical Assistance in the Development of the Manalapan Lake and Watershed Restoration / Implementation Plan

Project Requested By: New Jersey Water Supply Authority (NJWSA)

Date Project Initiated: April 2004

Project Officer Name: Fred S. Lubnow, Ph.D.

Address: Princeton Hydro, LLC
P.O. Box 720
1108 Old York Road, Suite 1
Ringoes, New Jersey 08551

Phone: (908) 237-5660

QA/QC Officer Name: Stephen J. Souza, Ph.D.

Address: Princeton Hydro, LLC
P.O. Box 720
1108 Old York Road, Suite 1
Ringoes, New Jersey 08551

Phone: (908) 237-5660

Project Description

A. Objective and Scope Statement

The New Jersey Department of Environmental Protection (NJDEP) recently completed a phosphorus-based total maximum daily load (TMDL) analysis for the Manalapan Lake watershed (NJDEP, 2003). Using the Unit Areal Loading (UAL) model, the NJDEP identified that an 86% reduction in the annual total phosphorus load will be required in order to achieve the Department's proposed water quality goals. A reduction of this magnitude is significant and will entail concerted, well-designed watershed management and in-lake restoration efforts. As such, both the NJDEP and the New Jersey Water Supply Authority (NJWSA) recognize that a variety of issues must be addressed in developing a feasible, site specific Restoration / Implementation Plan for the Manalapan Lake watershed.

The specific project issues of concern include managing the ecosystem processes and functions of Manalapan Lake as a shallow lake, updating and quantifying particular sources of phosphorus such as septic systems, and conducting a limited amount of water quality monitoring in order to evaluate the potential effectiveness of in-lake management strategies. This Quality Assurance Project Plan (QAPP) is for the water quality monitoring portion of this Lake and Watershed Restoration / Implementation Plan for Manalapan Lake.

The objective of the proposed project is to develop a Manalapan Lake Restoration / Implementation Plan that specifically addresses both in-lake and watershed-based issues of concern, with an emphasis placed on the phosphorus TMDL and the achievement of the targeted phosphorus-reducing goal set forth by the Department in that document. The Plan will also serve as a means of improving in-lake water quality conditions for both ecological and recreational reasons.

B. Data Usage

The data collected during this study will be utilized to develop the Lake and Watershed Restoration / Implementation Plan for Manalapan Lake. In addition, the data will provide a means of verifying the findings of the TMDL that were developed for the lake by NJDEP.

C. Sampling Procedures

All sampling procedures shall be in conformance with standard limnological practices and procedures listed in *Standard Methods for the Analysis of Water and Wastewater, 18th Edition* (American Public Health Association, 1992), State protocol (NJDEPE, 1992) and/or any applicable US EPA guidance document. Instrumentation used for the collection of field data (dissolved oxygen, temperature, pH and conductivity) shall be properly calibrated in conformance with manufacturer instructions. All sampling sites were chosen to be representative sites and are subject to the approval of the New Jersey Department of Environmental Protection and New Jersey Water Supply Authority.

The methodology for some of the biological parameters, such as chlorophyll *a*, phytoplankton and zooplankton, are described in *Standard Methods for the Analysis of Water and Wastewater, 18th Edition* (American Public Health Association, 1992). However, additional methodology will be utilized for some of the other biological parameters. For example, established US EPA protocol will be utilized for quantifying and assessing the fishery community of Manalapan Lake (US EPA, 1993).

D. Water Quality Monitoring Parameters and Frequency

1. Manalapan Lake will be monitored **five** times through the course of the 2004 **and 2005** growing season**s**. Specifically, monitoring events will be conducted in **August 2004, October 2004, April 2005, June 2005 and August 2005**. A total of two in-lake sampling

stations will be monitored during each sampling event (Appendix A). These stations will include a mid-lake sampling station (ST-1) and a near-inlet sampling station (ST-2).

2. At the two **in-lake** sampling stations a calibrated Surveyor IV Hydrolab will be used to monitor the *in-situ* parameters dissolved oxygen (DO), temperature, pH and conductivity. Data will be recorded at 0.5 - 1.0 meter increments beginning at 0.5 meters below the water's surface to within 0.5 meters of the lake's sediment bottom. In addition, water clarity will be measured at each station with a Secchi disk.

3. Discrete water quality samples will be collected the mid-lake sampling station (ST-1) of Manalapan Lake, approximately 0.5 meters below the water's surface with a Van Dorn or Kemmerer sampling bottle. These samples will be collected and delivered to a State certified laboratory for the analysis of total phosphorus, soluble reactive phosphorus, alkalinity, hardness, and total suspended solids. Additionally, a bottom (0.5 meters above the sediments) discrete water sample will be collected at the mid-lake sampling station and analyzed for total phosphorus, to quantify the lake's internal phosphorus load.

4. During each in-lake sampling event, *in-situ* data will be collected of Manalapan Brook, the lake's main inlet. Discrete samples will also be collected for the analysis of total suspended solids and total phosphorus at this inlet sampling station.

5. A set of stormwater samples will also be collected at Manalapan Brook during three stormwater events during the course of the 2004 **and 2005** growing season**s**. These stormwater samples will be analyzed for total suspended solids and total phosphorus. The stormwater samples will provide data that will be used to calibrate the surface runoff pollutant loads, particularly phosphorus, as identified in the State's TMDL (NJDEP, 2003).

6. A field duplicate and rinse blank will also be collected during each sampling event. Field duplicates will be collected from a different sampling station, and for a different water quality parameter, during each individual sampling event.

E. Biological Monitoring Parameters and Frequency

1. In addition to the water quality parameters, a number of biological parameters will also be monitored as part of this project. The collected biological data will provide detailed ecological information on the requirements and management of the nuisance and desirable aquatic species.

2. During each of the **five** sampling events, an additional sub-surface water sample (0.5 meter) with a Van Dorn or Kemmerrer sampling bottle at the mid-lake sampling station (ST-1). This additional water sample will be analyzed for chlorophyll *a*, a photosynthetic pigment possessed by all algae. Measuring the amount of chlorophyll *a* is an excellent means of quantifying the amount of algae in a lake.

3. During each of the **five** sampling events, whole water samples will be collected approximately 0.5 meters below the water's surface at the mid-lake sampling station for the identification and enumeration of phytoplankton.

4. Samples will be collected for zooplankton during each sampling event with a 12-liter Schindler Plankton Trap. At each of the two discrete in-lake sampling stations, the zooplankton samples will be collected approximately half way down the water column.

5. The phyto- and zooplankton will be identified to the most practical taxon, which tends to be either genus or species.

6. As shown in Table 1, the phytoplankton and zooplankton sampling protocol will be in accordance with *Standard Methods for the Examination of Water and Wastewater, 18th Edition* (American Public Health Association, 1992).

7. In addition to identifying the dominant organisms to genus or species, the abundance and biomass of the phytoplankton and zooplankton will be calculated as per Wetzel and Likens (1991).

8. Besides the plankton, qualitative data on the relative abundance and species composition of the aquatic macrophyte (plant) community at each sampling station of Manalapan Lake will be collected during each sampling event. This will also involve collecting near shoreline and open water observational data of resident aquatic vegetation, the identification of observed macrophytes to species, and the collection of data pertaining to the relative, location-specific densities and areal coverages. Such data will be extremely important in the formal consideration of potential aquatic plant management techniques.

9. A fishery survey of Manalapan Lake will also be conducted during the late spring / early summer season (May / June) of **2005**. Sampling methodology will focus on electroshocking. The methodology that will be utilized to conduct the fishery survey will closely follow protocol established by US EPA (1993).

F. Parameter Table

Summaries of all water quality parameters to be measured and analytical methods to be used are shown in Table 1. This table was developed in coordination with the independent analytical laboratory; Environmental Compliance Monitoring, Inc. (ECM), who will follow the methods and protocols listed in Table 1. ECM will be responsible for all laboratory analyses except for phytoplankton and zooplankton, which will be identified and enumerated by Princeton Hydro, LLC. Princeton Hydro, LLC will also conduct all *in-situ* water quality monitoring, as well as identify the collected aquatic plants and fish.

Information on project detection limits, levels of interest, precision and accuracy for parameters of interest is listed in Table 2. This table was developed in conjunction with Mr. Thomas Grenci of ECM, Inc. and indicates the data quality that is expected for this study.

Data Comparability: Analytical data comparability will be achieved by following the analytical methodology, preservation practices and holding times described in Table 1. Each parameter will be analyzed using the referenced methodology and changes in analytical procedures will not take place from sample to sample. The same holds true for sample preservation, holding times and QA/QC practices. The methods used are standard analytical methods that will also allow comparisons with data from the earlier projects.

Data Completeness: Data will be considered complete and usable for decision making when all results have been completed and submitted to the New Jersey Department of Environmental Protection and New Jersey Water Supply Authority in accordance with the sampling and analytical methodology and the required QA/QC practices listed in this project plan. However, it is recognized that some data loss may occur as a result of factors such as sampling equipment malfunction, losses during sample handling, or analysis outside of laboratory acceptance limits. Samples will be re-analyzed if results are outside of laboratory acceptance limits, providing that sufficient sample volume is available and that holding times for the affected parameters(s) have not been exceeded.

Table 1 – Parameters for the Manalapan Lake and Watershed Restoration / Implementation Plan

Parameter	Analytical Method Reference* (Standard Methods)	Sample Container and Preservation Method	Holding Time (Maximum)
Soluble Orthophosphate	4500-P E	1 Pint plastic, Filter, cool to 4□C	48 hours
Total Phosphorus	4500-P B-5 and 4500-P E	1 Pint plastic, H_2SO_4 added to pH <2, cool to 4□C	28 days
Alkalinity	2320	1 Pint plastic, cool to 4EC	14 days
Total Hardness	2340C	1 Pint plastic, HNO_3 added to pH <2, cool to 4EC	6 months
Total Suspended Solids	2540 D	1 Pint plastic, cool to 4□C	7 days
Conductivity Profile	2510 B	*in situ*	N/A
pH Profile	4500-H^+ B	*in situ*	N/A
Dissolved Oxygen Profile	4500-O G	*in situ*	N/A
Temperature Profile	2550 B	*in situ*	N/A
Chlorophyll *a*	10200 H 1 & 2	1 Quart plastic, then filter in field, freeze at -20□C	30 days
Phytoplankton	10200 F	1 Pint plastic, then Lugol's Solution added	6 months
Zooplankton	10200 G	1 Pint plastic then Lugol's Solution	6 months

* As per Standard Methods (American Public Health Association, 1992).

Table 2 - Information on Detection Limits, Precision and Accuracy for Water Quality Parameters

Parameter	Sample Matrix	Detection Limit	Level of Interest	Relative Percent Difference*	Percent Recovery*
Soluble Orthophosphate	Water	0.02 mg/L	0.02 mg/L	-24 to 24	75 to 125
Total Phosphorus	Water	0.02 mg/L	0.02 mg/L	-37 to 37	20 to 180
Alkalinity	Water	1 mg/L	1 mg/L	-14 to 14	80 to 120
Total Hardness	Water	3.6 mg/L	1 mg/L	-17 to 17	67 to 133
Total Suspended Solids	Water	1.0 mg/L	1.0 mg/L	-34 to 34	66 to 134

* As supplied by Environmental Compliance Monitoring, Inc.

Table 2 - Information on Detection Limits, Precision and Accuracy for Water Quality Parameters (continued)

Parameter	Sample Matrix	Detection Limit	Level of Interest	Relative Percent Difference*	Percent Recovery*
Conductivity Profile	Water	1 Φmhos/cm	1 Φmhos/cm	N/A	N/A
pH Profile	Water	0.1 Standard Unit	0.1 Standard Unit	N/A	N/A
Dissolved Oxygen Profile	Water	0.1 mg/L	0.1 mg/L	N/A	N/A
Temperature Profile	Water	0.5E Celsius	0.5E Celsius	N/A	N/A
Chlorophyll *a* *	Water	1 mg/m^3	1 mg/m^3	N/A	N/A
Phytoplankton	Water	N/A	N/A	N/A	N/A
Zooplankton	Water	N/A	N/A	N/A	N/A

* As supplied by Environmental Compliance Monitoring, Inc.

Project Schedule, Organization and Responsibility

Table 3 displays the sampling schedule for all field related activities associated with the development of the Lake and Watershed Restoration / Implementation Plan. The sampling schedule shown in Table 3 was developed to comply with NJWSA's schedule of completing the Lake and Watershed Restoration / Implementation Plan for Manalapan Lake by the end of 2005. This timetable is within NJDEP's original implementation schedule of having the Restoration / Implementation Plan portion of the project complete by the end of spring 2007 (NJDEP, 2003).

Princeton Hydro, LLC, under the direction of Dr. Fred S. Lubnow, will serve as the project manager. As project manager, responsibilities will include overall project coordination, data management, QA/QC, and the preparation of project reports, documents and deliverables. The review and approval of this QAPP will be under the direction of Mr. Nick Zripko of the New Jersey Department of Environmental Protection. Ms. Kathy Hale of the New Jersey Water Supply Authority will serve as the State's Project Manager for the project and will be responsible in ensuring that all identified tasks are conducted and completed in an acceptable manner.

Fiscal management and administration of the project will be the responsibility of the New Jersey Water Supply Authority (NJWSA), under the direction of Ms. Kathy Hale. Additional project support will be provided by the Middlesex County Department of Parks and Recreation and the Division of Environmental Health, Middlesex County Department of Public Health.

The key individuals who will be responsible for various project tasks are listed in Table 4. Dr. Fred S. Lubnow of Princeton Hydro, LLC will also be responsible for lake sampling operations and plankton identification. Environmental Compliance Monitoring Inc., of Neshanic Station, NJ, will perform the chemical analyses for the project under the direction of Mr. Thomas Grenci.

Table 3

Proposed Schedule of Field Activities for the Development of the Lake and Watershed Restoration / Implementation Plan For Manalapan Lake

Year 2004

Task	A	M	J	J	A	S
Water Quality Monitoring* of Manalapan Lake		X	X		X	
Stormwater Monitoring of Manalapan Brook		X		X		X
Fishery Survey of Manalapan Lake**		X	X			
Qualitative Aquatic Plant Surveys of Manalapan Lake		X	X		X	

* Water quality monitoring includes *in-situ* monitoring, measuring water clarity with a Secchi disk, and the collection of discrete samples for chemical and plankton analyses.

** Fishery survey will entail a one day electroshocking survey, which will be conducted in May or June of 2004

Table 4 - Project Responsibility

Area of Responsibility	Name	Affiliation
State-Based Project Management	Mr. Nick Zripko	New Jersey Department of Environmental Protection
Project Management	Fred Lubnow, Ph.D.	Princeton Hydro, LLC
Laboratory Analysis	Thomas Grenci	Environmental Compliance Monitoring, Inc.
Laboratory QC	Suzanne Armbruster	Environmental Compliance Monitoring, Inc.
Phytoplankton and Zooplankton Analyses	Fred Lubnow, Ph.D.	Princeton Hydro, LLC
Data Processing	Fred Lubnow, Ph.D.	Princeton Hydro, LLC
Data Processing QA/QC Officer	Stephen Souza, Ph.D.	Princeton Hydro, LLC
Data Quality Review	Stephen Souza, Ph.D.	Princeton Hydro, LLC
Performance Auditing	Ms. Kathy Hale	New Jersey Water Supply Authority
Systems Auditing	-----	New Jersey Department of Environmental Protection
Overall QA	Fred Lubnow, Ph.D.	Princeton Hydro, LLC
Overall Coordination	Fred Lubnow, Ph.D.	Princeton Hydro, LLC

Chain of Custody Procedures

Chain of Custody (COC) procedures will be utilized once the samples are collected and transported to the laboratory for analysis. Personnel responsible for sampling operations will inform the analytical laboratory at least twenty-four (24) hours in advance of the date that lake monitoring samples will be delivered.

The sample collector will be required to record the following information on the sampling container and field data sheet: sample number and/or station, date and time of collection, source, preservation technique and collector's name. The sample collector will also record pertinent field data; field observations and the analyses required in the field data sheets. A chain of custody form will be completed to identify the analyses requested and will be submitted to the laboratory at the time of sample delivery.

Following collection, samples will be placed on ice in an insulated container for transport to the laboratory. The sample collector or Princeton Hydro, LLC will deliver the samples to the laboratory, where laboratory personnel will visually inspect all sample containers to confirm the method of transportation, date of collection and preservation technique. Samples will not be accepted and fresh samples will be requested if for any reason the holding time was exceeded, proper preservation techniques were not followed or transportation conditions were unsuitable.

Calibration Procedures and Preventive Maintenance

Field equipment will be calibrated on each sampling date in accordance with the manufacturer's instructions. Any problems will be corrected before samples are collected.

The Surveyor IV Hydrolab will be used to monitor temperature, dissolved oxygen, pH and conductivity. Prior to each sampling event, the Hydrolab will be calibrated for these water quality parameters. The calibration standards will bracket the expected range for the monitoring. All of the calibration information will be documented. Calibration information will include, but will not be limited to, dates of calibration, name of person performing calibration, any problems and, if so, how they were corrected.

Environmental Compliance Monitoring, Inc. is a State-certified Laboratory that maintains an active Quality Assurance/Quality Control (QA/QC) program to ensure that the collected data will meet all project requirements and that laboratory instruments are properly calibrated. Standards will be analyzed with each batch of samples to ensure that instruments are operating properly. These procedures are in accordance with all applicable State and Federal regulations.

Documentation, Data Reduction, and Reporting

All QA/QC data and project information will be collected according to applicable State and Federal regulations. All data will be included in the final Lake and Watershed Restoration / Implementation Plan reports and will be kept on file by Princeton Hydro, LLC for a minimum of five years.

Data Validation

Data validation will be performed by Princeton Hydro, LLC and will be provided with the final report. If blank contamination is found in the equipment rinse blank, all water quality data with results less than five (5) times the concentration found in the blank should be flagged "B". The "B" qualifier indicates that the reported result may be an anomaly as a result of contamination of the blank.

Performance and Systems Audits

A. Performance Auditing

ECM is a State of New Jersey certified laboratory (Certification #18630). The laboratory participates in Performance Evaluation (PE) Studies for each category of certification and accreditation and is required to pass each of these PE studies in order to maintain certification. The NJDEP conducts performance audits of each laboratory that is certified or accredited.

ECM also participates in several additional programs to ensure data accuracy. The laboratory participates in US EPA water pollution (WP) and water supply (WS) studies and the discharge monitoring report (DMR-QA/QC) program.

Princeton Hydro is State certified (State ID # 10006) for the collection of water samples and *in-situ* field monitoring of temperature, pH, dissolved oxygen and conductivity using a multi-probe data sonde and similar monitoring meters.

B. Systems Auditing

The NJDEP periodically conducts on-site Technical Systems Audits (TSA) of each certified laboratory. The findings of these audits, together with the US EPA Performance Evaluation results, are used to update each laboratory's certification status.

Corrective Action

The project QA Officer will ensure that all data for the project are generated in accordance with procedures outlined in this QA/QC Project Plan. Quality control samples will be analyzed with each sample batch and results will be provided with the data reports. If a QC sample provides unacceptable results during any given day, the sample analysis must be repeated for those parameters affected. All project participants will immediately report any deficiencies to the QA Officer. The QA Officer will recommend appropriate corrective action and determine the acceptability of affected data when deficiencies are noted.

The QA Officer will notify the Project Officer of any unacceptable data to ensure that it is not included in evaluations of water quality for reporting purposes. The QA Officer shall notify the Project Officer in writing anytime a deviation from the approved plan occurs. Results of all corrective actions will then be documented.

Reports

Monthly progress reports will be submitted to the NJWSA and NJDEP. The progress reports will include monitoring data, a description of completed and planned activities, and other project task-related information. All data collected, as part of this project, will be integrated into the Lake and Watershed Restoration / Implementation Plan. A final report will be prepared at the conclusion of the Project. The final report will include a summary of the water quality conditions of Manalapan Lake, as well as a Lake and Watershed Restoration / Implementation Plan, designed to reduce existing phosphorus loads to satisfy the targeted TMDL goals, as well as improve the recreational and ecological status of the lake. All limnological and watershed data will also be included in the final report and will be provided to NJWSA, NJDEP, Middlesex County Department of Parks and Recreation and the Division of Environmental Health, Middlesex County Department of Public Health.

References

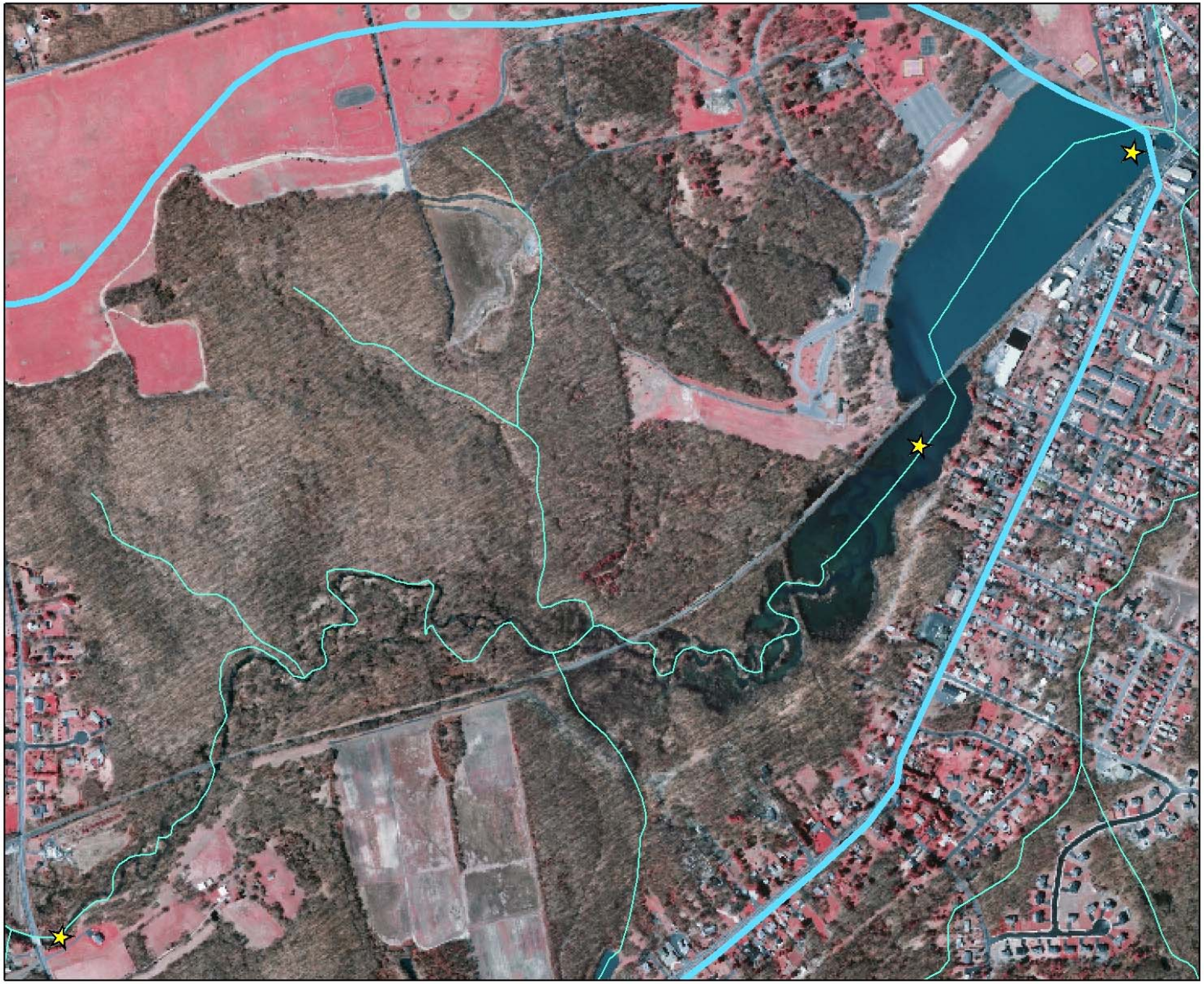
American Public Health Association. 1992. *Standard Methods for the Analysis of Water and Wastewater, 18th Edition*. Washington, D.C.

New Jersey Department of Environmental Protection and Energy. 1992. *Field Sampling Procedures Manual*. Trenton, New Jersey.

New Jersey Department of Environmental Protection. 2003. *Amendment to the Northeast Water Quality Management Plan, the Lower Raritan-Middlesex Water Quality Management Plan, and the Monmouth County Water Quality Management Plan. Total Maximum Daily Loads for Phosphorus to Address 5 Eutrophic Lakes in the Raritan Water Region*. Division of Watershed Management. Trenton, New Jersey.

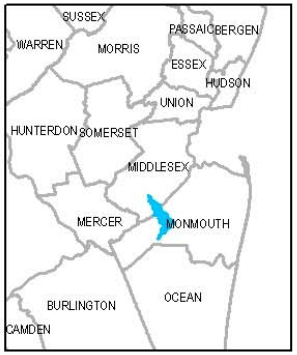
United States Environmental Protection Agency. 1993. *Fish and Fisheries Management in Lakes and Reservoirs. Technical Supplement to The Lake and Reservoir Restoration Guidance Manual*. Water Division (WH-553). EPA-841-R-93-002. Washington, D.C.

Wetzel, R.B., and G.E. Likens. 1991. *Limnological Analysis, Second Edition*. Springer – Verlag. New York.



Princeton Hydro

NEW JERSEY COUNTY MAP



PRINCETON HYDRO, LLC.
1108 OLD YORK ROAD
P.O. BOX 720
RINGOES, NJ 08551

Feet
0 300 600
1 inch equals 600 feet

SOURCES:

1. 2002 Aerial Photograph obtained from the New Jersey Image Warehouse
2. Manalapan Lake Watershed obtained from the NJ DEP, Div. of Watershed Management
3. Sampling Station Locations GPS'd by Princeton Hydro personnel

SAMPLING STATION LOCATIONS

New Jersey Water Supply Authority
Manalapan Lake
Watershed Restoration Plan

Legend

- Watershed Boundary
- Sampling Stations
- Streams

File: P:\0467\projects\0467002\GIS\MOA\Sample_Stations.mxd

QUALITY ASSURANCE PROJECT PLAN (QAPP)

New Jersey Water Supply Authority

604b Memorandum of Agreement for Phase II Raritan Basin Watershed Management Plan

Manalapan Lake Watershed Restoration /Implementation Plan

Prepared by:_____ Date: 7/14/05
Fred S. Lubnow, Ph.D., Project Manager
Princeton Hydro, LLC

Reviewed by:_____ Date: 7/14/05
Stephen J. Souza, Ph.D., QA/QC Officer
Princeton Hydro, LLC

Reviewed by:_____ Date: _____
Kathy Hale, Project Manager
New Jersey Water Supply Authority

Reviewed by:_____ Date: _____
Nick Zripko, NJDEP Project Manager
NJDEP Bureau of Watershed Planning

Reviewed by:_____ Date: _____
Helen Rancan, Statewide NPS Coordinator
NJDEP Bureau of Watershed Planning

Approved by:_____ Date: _____
Marc Ferko, Quality Assurance Officer
NJDEP Office of Quality Assurance

QUALITY ASSURANCE PROJECT PLAN

MANALAPAN LAKE
MIDDLESEX COUNTY, NEW JESERY

Submitted for the Development of the Manalapan Lake and Watershed Restoration / Implementaion Plan

Submitted to:

New Jersey Department of Environmental Protection
Division of Watershed Management
P.O. Box 418
Trenton, New Jersey 08625-0418

Prepared by:

Princeton Hydro, LLC
P.O. Box 720
1108 Old York Road, Suite 1
Ringoes, New Jersey 08551

April 2004
Addendum - July 2005

This addendum to the Quality Assurance Project Plan is being submitted to reflect two additional water quality monitoring events requested by the Manalapan Lake Watershed Restoration / Implementation Plan subcommittee and approved by NJDEP.

1. Two additional water quality monitoring events will be conducted during the 2005 sampling season. Specifically, monitoring events will be conducted in July 2005 and August 2005. A total of two in-lake sampling stations will be monitored during each sampling event as indicated in Appendix A of the previously approved QAPP. These stations will include a mid-lake sampling station (ST-1) and a near-inlet sampling station (ST-2).

2. At the two sampling stations a calibrated Surveyor IV Hydrolab will be used to monitor the in situ parameters dissolved oxygen (DO), temperature, pH and conductivity. Data will be recorded at 0.5 - 1.0 meter increments beginning at 0.5 meters below the water's surface to within 0.5 meters of the lake's sediment bottom. In addition, water clarity will be measured at each station with a Secchi disk.

3. Discrete water quality samples will be collected the mid-lake sampling station (ST-1) of Manalapan Lake, approximately 0.5 meters below the water's surface with a Van Dorn or Kemmerer sampling bottle. These samples will be collected and delivered to a State certified laboratory for the analysis of total phosphorus, soluble reactive phosphorus, alkalinity, hardness, and total suspended solids. Additionally, a bottom (0.5 meters above the sediments) discrete water sample will be collected at the mid-lake sampling station and analyzed for total phosphorus, to quantify the lake's internal phosphorus load.

4. During each in-lake sampling event, in situ data will be collected in Manalapan Brook, the lake's main inlet. Discrete samples will also be collected for the analysis of total suspended solids and total phosphorus at this inlet sampling station.

5. A field duplicate and rinse blank will also be collected during each sampling event. Field duplicates will be collected from a different sampling station, and for a different water quality parameter, during each individual sampling event.

6. Water quality samples will be collected using the same methodology described in the approved QAPP.

Supplement to the Approved Quality Assurance Project Plan For Manalapan Lake, Middlesex County, New Jersey

Prepared by:

Princeton Hydro, LLC
120 East Uwchlan Avenue
Suite 204
Exton, Pennsylvania 19341
Phone: 610-524-4220
Fax: 610-524-9434
flubnow@princetonhydro.com

A Quality Assurance Project Plan (QAPP) was approved by NJDEP in 2004, and later expanded and approved in August 2005, for in-lake and stream monitoring of Manalapan Lake and its main inlet Manalapan Brook, respectively. The lake and main inlet were monitored two times in 2004 and three times in 2005. This proposed supplement is being requested to implement the exact in-lake and stream monitoring program for the lake and brook through the 2008 growing season. Specifically, a total of four monitoring events will be conducted through 2008: spring (April), late spring / early summer (late May / early June), mid-summer (July) and late summer (late August / early September).

As was already approved in the August 2005 QAPP, during each sampling event, *in-situ* monitoring will be conducted with a calibrated meter for temperature, dissolved oxygen, pH and conductivity. *In-situ* data will be collected from surface to bottom at 0.5 to 1.0 meter intervals and water clarity will be measured with a Secchi disk. Sub-surface discrete water samples will be collected at the in-lake station for total phosphorus, soluble orthophosphorus, total suspended solids and chlorophyll *a*. In addition a bottom water sample will be collected and analyzed for total phosphorus. Finally, vertical net tow samples will also be collected for a qualitative examination of the resident phytoplankton and zooplankton.

The same set of NJDEP approved field protocol and laboratory methodology used to monitor Manalapan Lake and Brook in 2004 and 2005 will also be used during the proposed 2008 monitoring year. Again, no change or modification to the already approved QAPP is being proposed. This supplement to the QAPP is a request to allow monitoring to be conducted during the 2008 growing season.

Supplemental Water Quality Monitoring Program for Manalapan Lake, Middlesex County, New Jersey

3 April 2008

Prepared by:

Princeton Hydro, LLC
120 East Uwchlan Avenue
Suite 204
Exton, Pennsylvania 19341
Phone: 610-524-4220
Fax: 610-524-9434
flubnow@princetonhydro.com

At the request of NJDEP, Princeton Hydro is submitting this proposal to provide supplemental in-lake monitoring of Manalapan Lake, Middlesex County, New Jersey. The proposed sampling program would mirror the baseline in-lake monitoring that will be implemented in 2008 under the recently approved QAPP.

The supplemental monitoring will include the collection of *in-situ* data at 0.5 – 1.0 meter intervals from surface to bottom at the two in-lake sampling stations (see included Figure). The *in-situ* parameters will include dissolved oxygen, temperature, pH and conductivity. A Surveyor IV Hydrolab or similar meter will be used to collect the *in-situ* data; the meter will be calibrated prior to any monitoring of Manalapan Lake. Water clarity will also be measured at each in-lake sampling station with a Secchi disk. *In-situ* data will also be collected at the in-stream sampling station located upstream of the lake (see included Figure).

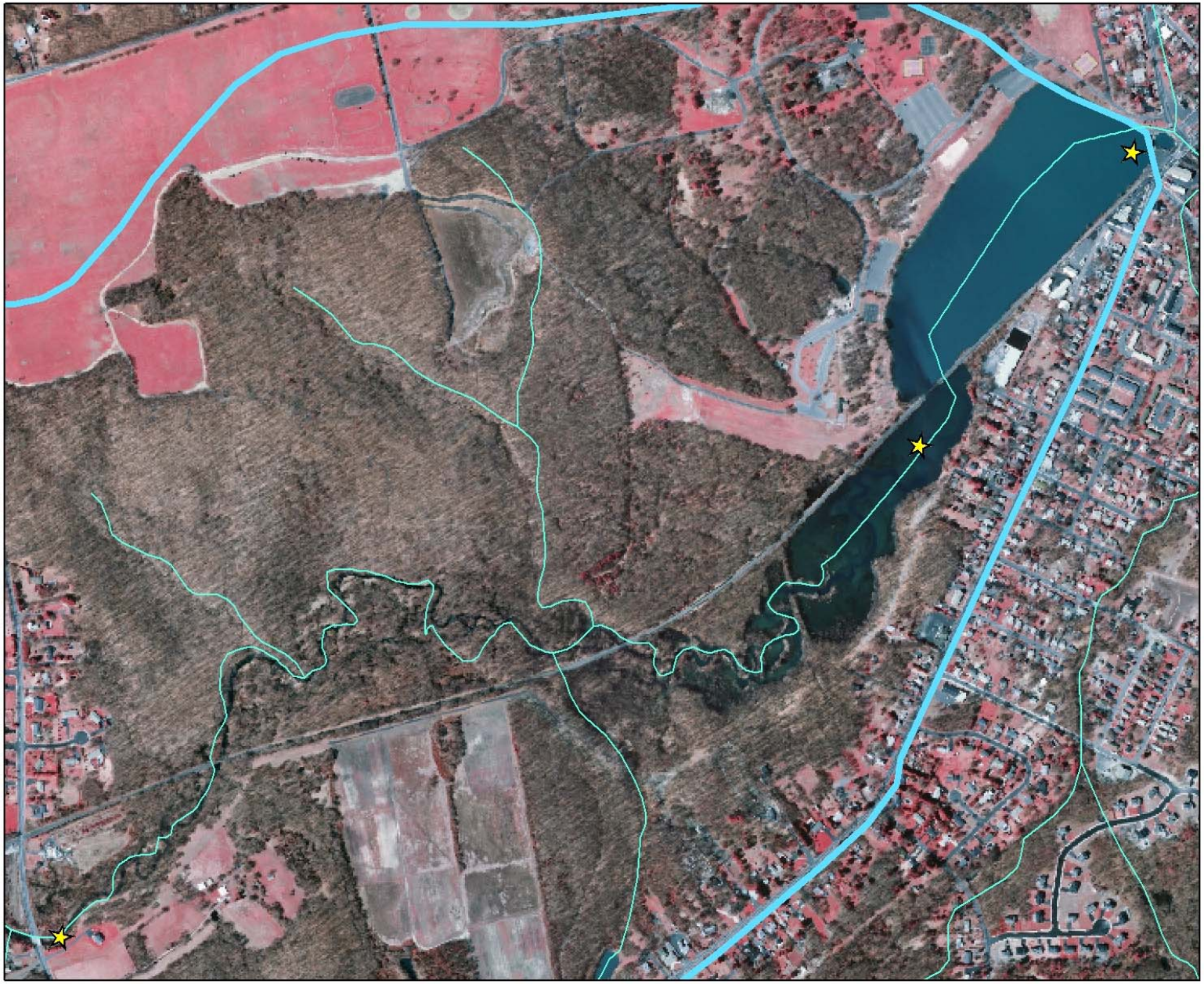
Discrete water samples will be collected at the mid-lake sampling station, adjacent the dam, at approximately 0.5 meters below the water's surface with a Van Dorn or Kemmerer sampling device. The samples will be collected and delivered to a State certified laboratory for the analysis of total phosphorus, soluble reactive phosphorus and total suspended solids. A bottom water sample, approximately 0.5 meters above the sediments, will be collected at the mid-lake station and analyzed for total phosphorus to quantify the lake's internal phosphorus load. Additionally, a water sample will be collected at the in-stream sampling station (upstream of the lake) and analyzed for total phosphorus and total suspended solids.

A field duplicate and rinse blank will also be collected during each sampling event. Field duplicates will be collected from a different sampling station and for a different water quality parameter, during each individual sampling event.

Another water sample will be collected approximately 0.5 meters below the water's surface at the mid-lake station and analyzed for chlorophyll *a* to quantify algal biomass. Finally, vertical net tow samples will also be collected for a qualitative examination of the resident phytoplankton and zooplankton.

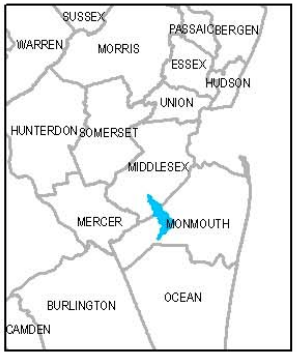
The same set of NJDEP approved field protocol and laboratory methodology used to monitor Manalapan Lake and Brook in 2004, 2005 as well as during the anticipated monitoring in 2008, would be used for these proposed additional water quality activities.

Each monitoring event can be conducted for a fixed price of $2,600.00, which includes all labor, field monitoring, laboratory analyses, and a summary letter report assessing in-lake conditions. Thus, if four sampling events are scheduled, the total fixed price would be $10,400.00. These four additional sampling events could occur in 2008 (in addition to the four already proposed under the existing project) and/or in 2009. The actual date of the sampling events will be determined by NJDEP. Thus, if these additional monitoring activities are funded, a total of eight in-lake sampling events will occur at Manalapan Lake over the 2008 and 2009 growing seasons.



Princeton Hydro

NEW JERSEY COUNTY MAP



PRINCETON HYDRO, LLC.
1108 OLD YORK ROAD
P.O. BOX 720
RINGOES, NJ 08551

Feet
0 300 600
1 inch equals 600 feet

SOURCES:

1. 2002 Aerial Photograph obtained from the New Jersey Image Warehouse
2. Manalapan Lake Watershed obtained from the NJ DEP, Div. of Watershed Management
3. Sampling Station Locations GPS'd by Princeton Hydro personnel

SAMPLING STATION LOCATIONS

New Jersey Water Supply Authority
Manalapan Lake
Watershed Restoration Plan

Legend

- Watershed Boundary
- Sampling Stations
- Streams

File: P:\0467\projects\0467002\GIS\MOA\Sample_Stations.mxd

Manalapan Lake Fishery Survey
18-Apr-05

TRANSECT #1

Fish Species	1"-3"	3"-6"	6"-9"	9"-12"	12"+
White Sucker					1 (20")
Yellow Bullhead			40		
Pumpkinseed	3	5	3		
Chain Pickerel					1 (15")
Yellow Perch		1			
Bluegill	1	1			
American Eel					2 (36"+)

TRANSECT #2

Fish Species	1"-3"	3"-6"	6"-9"	9"-12"	12"+
White Sucker					1 (20")
Yellow Bullhead			119		
Pumpkinseed	4	4			
Yellow Perch		3			
Bluegill		1			
American Eel	24				
Largemouth Bass		1			
American Carp					1 (20")

TRANSECT #3

Fish Species	1"-3"	3"-6"	6"-9"	9"-12"	12"+
Yellow Bullhead		50			
Pumpkinseed		2	2		
Yellow Perch					1 (13")
Bluegill	4	11	1		
Black Crappie				1	
Golden Shiner			1		

TRANSECT #4

Fish Species	1"-3"	3"-6"	6"-9"	9"-12"	12"+
Yellow Bullhead		57			
White Sucker					1 (22")
Largemouth Bass					1 (14")

TRANSECT #5

Fish Species	1"-3"	3"-6"	6"-9"	9"-12"	12"+
		NO CATCH			

TRANSECT #6

Fish Species	1"-3"	3"-6"	6"-9"	9"-12"	12"+
Yellow Bullhead		1			
White Sucker					2 (19", 20")

SPECIES	TOTAL	
White Sucker	5	
Yellow Bullhead	267	76%
Pumpkinseed	23	
Chain Pickerel	1	
Yellow Perch	5	
Bluegill	19	
American Eel	26	
Largemouth Bass	2	
American Carp	1	
Black Crappie	1	
Golden Shiner	1	
ALL	**351**	

DESIGN PROJECT DOCUMENT FOR WETLAND WATER QUALITY BASIN RETROFIT
STATION #32
OAKWOOD TRAIL / NEW STREET
MONROE TOWNSHIP
Middlesex County, New Jersey

Prepared for:

New Jersey Water Supply Authority
on behalf of the Manalapan Brook Watershed
Restoration and Protection Plan Project Committee
Watershed Protection Programs
74 East Main Street
Somerville, New Jersey 08876-2312
(P) 908.685.0315 • (F) 908.685.0195
Email: khale@raritanbasin.org

Prepared by:

Princeton Hydro, LLC

120 East Uwchlan Avenue, Suite 204
Exton, Pennsylvania 19341
(P) 610.524.4220 • (F) 610.524.9434
Email: flubnow@princetonhydro.com

February 2011

Introduction and Project Description

The Wetland Water Quality Retrofit project is located in an existing "dry" detention basin in Monroe Township. The design objective of the retrofit is to enhance the water quality benefits of the basin by improving the basin's removal of Total Suspended Solids (TSS).

The existing basin has a single inlet and a series of concrete low flow channels which convey flow directly to the outlet structure. The current configuration of the basin does not provide substantial TSS removal due to the lack of vegetation and the directly connected concrete low flow channels. The proposed design features include the removal of concrete low flow channels, the creation of a forebay and stone filter berm, the elongation of the flow path, and a complete re-vegetation of the basin.

Under proposed conditions, the flow from smaller, more frequent storm events will have access to the entire basin. The flow path during these smaller events will be substantially lengthened under proposed conditions. This will maximize the runoff contact time with vegetation, decrease flow velocity and therefore promote the removal of TSS.

The basin was evaluated to determine if the retrofit could be designed to provide infiltration of incoming stormwater runoff; however, it was determined that the close proximity of the groundwater table would be prohibitive to the design of an infiltration system. The proposed retrofit will likely increase the volume control of runoff to some extent due to the removal of the concrete low flow channels and the minor regrading proposed in the basin; however, no infiltration is explicitly accounted for in the design of this retrofit. The proposed design plans also provide provisions to improve the operation and maintenance of the basin to facilitate sediment and debris removal from the basin.

Ancillary benefits of the project include aesthetic improvements to the basin; largely due to the proposed addition of native vegetation in the basin. The project will also greatly increase the ecological value of the basin. The proposed condition of the basin will minimize the need for periodic mowing of the basin which is currently conducted by the township. The design plans also propose a location for potential educational signage. The material quantities and associated labor for the proposed design plans for station #32 were used to calculate a construction cost estimate of $44,000 for the project.

Property Access and Ownership

The basin is owned and operated by Monroe Township. The detention basin is located on Block 68.02, Lot 19 of Monroe Township. Potential property access for project implementation will occur along the New Street frontage of the basin where there is an existing depressed curb and asphalt paved access location.

Project Permitting

The implementation of this project will not require a significant amount of permitting. The following permitting guidance has been prepared to summarize the anticipated permitting requirements and thereby streamline the permitting process. This permitting information is current as of the preparation of this document but is subject to potential changes in state regulations depending on the actual implementation date of the project. Project-specific details related to all potential permitting agencies are further described in the following sections.

Flood Hazard Area Regulations

The Flood Hazard Area Control Act Rules detail the requirements for any disturbance in riparian areas. Areas regulated under these rules include the riparian zone and the flood hazard area which includes the flood fringe and floodway.

The NJDEP surface water quality standards (N.J.A.C. 7:9) designate Barclay Brook as a FW2-NT waterway, a freshwater stream which does not support trout production or trout maintenance. The project site is located in an outcrop of the Magothy formation. The Magothy formation is identified by the state as an area containing acid producing soils. Therefore, in accordance with N.J.A.C. 7:13-4.1(a)2, the riparian zone in this area is defined as the area contained within a 150 foot buffer from the top of bank as shown in the plan set. The riparian zone encompasses a small portion of the basin in the vicinity of the outlet control structure.

Manalapan Brook is a NJDEP delineated waterway as described in N.J.A.C. 7:13-3.3. Based on an analysis of the state flood hazard area mapping the basin is not located within the flood hazard area.

The project has been designed such that no proposed modifications or disturbance are located within the small portion of the basin which is encumbered by the riparian zone. Consequently, no regulated work is proposed within the regulated area and no flood hazard area permitting is required for the project. As a result there is no flood hazard area fee associated with the project.

Any maintenance activities currently performed by Monroe Township in this portion of the basin would require a general permit (GP) in accordance with N.J.A.C. 7:13-8.6 (General permit 4 for stormwater maintenance by a public utility). There are no fees associated with a general permit 4. The potential requirement for this general permit is independent to this design project.

Freshwater Wetlands Permitting

This project involves a retrofit of a lawfully existing stormwater management basin. The basin was constructed in an uplands area. Therefore, it is unlikely that the state would

consider any areas contained within the basin as jurisdictional wetlands or state open waters.

There are riparian areas along Barclay Brook which may contain wetlands. Based on a review of the New Jersey Landscape Project data, it is unlikely that wetlands potentially delineated in these areas would be anything but ordinary in resource value. Ordinary resource value wetlands do not have any transition area associated with them. Therefore it is not likely that there would be any wetland transition areas within the area of the proposed work.

It is recommended that a wetlands delineation be conducted at the site to confirm that there are no jurisdictional wetlands or transition areas within the project area. The fees associated with the Freshwater Wetlands permitting include a $600 letter of interpretation review fee plus an additional $84 per project area acre ($84 in this case). Depending on the funding source for the project implementation, these fees may potentially be waived by the NJDEP. The estimated cost for the delineation and all supporting paperwork is $2,500.

Soil Erosion and Sediment Control

The project is located within Middlesex County, therefore the Freehold Soil Conservation District will take jurisdiction for this project. Under the purview of the Soil Erosion and Sediment Control Act of 1975 (N.J.S.A. 4:24-39 and N.J.A.C. 2:90-1.1), a project that disturbs greater than 5,000 square feet of land area must apply to the county soil conservation district for a soil erosion and sediment control plan approval. The total disturbance area for this project is 43,075 square feet.

Since the project exceeds the 5,000 square foot threshold, the project will require a soil erosion and sediment control plan certification. A fee of $975 is expected in accordance with the Freehold Soil Conservation District fee schedule. Three (3) copies of the plan set must be submitted along with the application fee.

Hydrologic Calculations

The detention basin was built prior to 2002 to manage stormwater runoff from the adjacent residential development along Spruce Meadow Drive, Black Oak Court, and Walnut Street. The total drainage area to the detention basin is approximately 18 acres. The soils in the area are predominantly defined by a hydrologic soil group ‘C’ classification.

A hydrologic model was created to calculate the peak flow rates and corresponding peak water surface elevations in the basin. The Army Corps of Engineers HEC-HMS model was used for all hydraulic and hydrologic calculations. Time of concentration calculations were performed using the TR-55 methodology. Flows were routed through the basin using the Modified Puls methodology with geometry based on the surveyed

information. The outflow structure elevations and geometry were also input based on the information contained in the existing conditions survey conducted as part of this work.

The model indicated that the peak flow rate resulting from the 25-year design storm for Middlesex County (6.4 inches in 24 hours, Type III distribution) resulted in a peak inflow rate of 37 cubic feet per second (cfs). Routing of the two-year design storm for Middlesex County (3.5 inches in 24 hours, Type III distribution) resulted in a peak elevation in the basin of 56.68 feet.

Calculations were conducted in accordance with the Standards for Soil Erosion and Sediment Control in New Jersey, Section 12. These calculations indicated that a standard rip rap apron would need to have a length "La" of 18.9 feet. The median stone diameter calculations for an apron at the inlet location (using a tail water "TW" of 1.1 feet) result in a diameter of 5.8 inches. The centerline of the proposed stone filter berm is 15 feet from the outfall to facilitate maintenance by standard equipment. The stone extends to a maximum length of 20 feet from the outfall, which exceeds the length requirement for an apron.

Manning's equation was used to calculate the capacity of the proposed channel (flow path) in the basin. Based on a slope of 0.0030 (ft/ft) and a Manning's 'n' of 0.035 the channel has the capacity to convey 27 cfs at a velocity of 2.0 feet per second (fps). It should be noted that the capacity of the low flow orifice on the outlet structure is only approximately 6 cfs, therefore, by design, flow rates on the order of 27 cfs will quickly back up and create much slower velocities within the basin.

Operation and Maintenance

The long-term operation and maintenance requirements for this design project are minimal. The most critical and the majority of the operation and maintenance requirements will occur during the first year or two following project implementation.

During the first two years following project implementation, the basin should be inspected on a monthly basis and immediately following a rainfall event of one inch or more. The flow channel should be inspected to ensure that all the seams of the erosion control blankets are intact and that no erosion features are forming. The stone filter berm should be inspected to ensure that the berm is stable and that the stone protection has not become dislodged.

The vegetation in the basin should be inspected on a monthly basis during the first two years of operation to ensure that all the proposed plants become successfully established. Vegetative cover should be maintained at a minimum of 85% coverage. Any dead shrubs or trees should be replaced. Areas of insufficient seed germination should be reseeded according the original design plan and immediately protected with additional erosion control blankets.

During initial establishment, and continued thereafter, the project should be monitored for invasive plant species. Based on observations within the watershed this may include Japanese knotweed (*Polygonum cuspidatum*), common reed (*Phragmites australis*), mugwort (*Artemisia vulgaris*), and multiflora rose (*Rosa multiflora*). Frequent monitoring of the project for these and other potential invasive plants during the initial establishment period (1-2 years) will significantly reduce the propensity of the project to become established with these invasive and less-desirable species. The broadleaf cattail (*Typha latifolia*) is a native species and has been previously observed in the basin. This plant is not included in the planting plan; however, it is a native species and is rarely considered a weed. The plant will likely only tend to inhabit the lower sections of the basin and will not interfere with the design intention of the basin retrofit.

Maintenance access to both the inlet structure and the outfall structure have been provided and shown on the plans. Maintenance access to the basin will occur through the existing depressed curb and asphalt paved staging along the basin's New Street frontage.

The basin should be inspected on a monthly basis. Long-term maintenance of the basin will primarily be limited to the periodic removal of sediment from the forebay created by the stone filter berm. This can be performed by hand or with a rubber tire mounted excavator. Accumulated sediment should be removed on an annual basis at a minimum or more frequently if inspections indicate that a more frequent sediment removal is necessary. Removed sediment should be disposed of in accordance with all applicable local, state and federal regulations.

Similar to existing conditions, periodic removal of trash and debris will also be required. The retrofit will tend to concentrate this material in the forebay behind the stone filter berm which will facilitate the removal of debris.

Currently the entire basin is mowed on a relatively frequent basis. Under the proposed conditions, only the side slopes and maintenance access paths will require periodic (monthly) mowing.

Specifications

The organization that bids and contracts this project for construction should attach their construction specifications document and any other bid documents required by their contracting staff. Each organization's requirements for specifications and bid documents will be different. Much of the specific information that must be referenced in those documents is contained on the plan sheets and can be inserted into an organization-specific set of specifications. A sample table of contents which outlines many of the basic specifications that will likely be required for this for this project is included below.

Sample text for rip rap is included within this Sample Table of Contents to provide an example of the information that would be included within project specifications.

SAMPLE TABLE OF CONTENTS

Section 011000 – Summary

Section 012500 – Substitution Procedures

Section 013233 – Photographic Documentation

Section 015000 – Temporary Facilities and Controls

Section 015500 – Construction access and parking

Section 015626 – Temporary Fencing

Section 015639 – Temporary Tree and Plant Protection

Section 015719 – Environmental protection

Section 017113 – Mobilization & demobilization

Section 017300 – Execution

Section 017700 – Closeout procedures

Section 024119 – Selective structure demolition/removal

Section 311413 – Soil stripping and stockpiling

Section 312000 – Earth moving

Section 312319 – Dewatering

Section 312500 – Soil erosion and sediment control

Section 313219 – Geosynthetic soil stabilization

Section 313700 – Rip rap

1. Prior to the placement of rock riprap, filter aggregate, bedding or geotextiles, the subgrade surfaces shall be cut, filled, compacted and graded to the lines and grades as shown on the project drawings. All subgrade surfaces shall be prepared so as to be reasonably smooth, and free of mounds, dips, or windrows.
2. The placement of fill to meet design grades and elevations shall be of an approved material, and placement shall include adequate compaction of the materials.

3. No riprap, filter/ bedding aggregate or geotextile shall be placed until the subgrade is inspected and approved by the project engineer.
4. Placed as shown on the contract drawings and/or as set in these specifications.
5. Rip rap shall be placed by equipment on the surfaces and to the depths specified on the contract drawings.
6. Rip rap to be installed to the full course thickness in one operation and in such a manner as to avoid displacement of underlying subgrade or geotextile.
7. Rip rap shall be delivered in a manner that will insure homogeneous mixture of rip rap.
8. Existing rip rap shall be stockpiled and reused on site, as specified on the contract drawings. additional rip rap may be required and shall conform to the following specifications:

    a. Riprap shall be constructed of rock obtained from a source that is approved by the engineer prior to execution of a contract for the project. When possible, consideration should be given to obtaining rock that is similar in color and texture to the existing stone in the project area.
    b. Rip rap should consist of machined shot rock that is angular and clean. Rounded stones or cobbles are not to be used.
    c. Rip rap should not contain sand, dust, organic material, cracks, mineral lenses, intrusions or other impurities
    d. Filter fabric shall be placed between rip rap and ground surface.
    e. The size of the rock to be used is shown on the contract drawings

Section 329100 – Planting preparation

Section 329200 – Turf and grasses

Section 329300 – Plants

Section 334100 – Storm utility drainage piping

DESIGN PROJECT DOCUMENT FOR MANALAPAN LAKE SHORELINE STABILIZATION STATION #37 AT THOMPSON PARK MONROE TOWNSHIP

Middlesex County, New Jersey

Prepared for:

New Jersey Water Supply Authority, on behalf of the
Manalapan Brook Watershed Restoration and
Protection Plan Project Committee
Watershed Protection Programs
74 East Main Street
Somerville, New Jersey 08876-2312
(P) 908.685.0315 • (F) 908.685.0195
Email: khale@raritanbasin.org

Prepared by:

Princeton Hydro, LLC

120 East Uwchlan Avenue, Suite 204
Exton, Pennsylvania 19341
(P) 610.524.4220 • (F) 610.524.9434
Email: flubnow@princetonhydro.com

February 2011

Introduction and Project Description

The Manalapan Lake Shoreline Stabilization project is located in Thompson Park along the southern shoreline of Manalapan Lake. The stabilization measures are distributed along a total of approximately 600 linear feet of eroded shoreline. The stabilization measures include the establishment of native vegetation, regrading, erosion control blankets and the installation of coir logs. The objective of these design measures is to reduce Total Suspended Solids (TSS) loading originating from the continued erosion and degradation of the Manalapan Lake shoreline. The persistent erosion along this area is a result of numerous factors including wind-driven wave action erosion and exposed soil conditions related to extensive Canada geese herbivory of shoreline vegetation.

The proposed design features will provide a shoreline that can dissipate and resist the wind-driven wave action along the shoreline. The design will also create a shoreline that will deter the Canada geese which frequent the lake. The proposed aquatic vegetation will reduce the wind-driven wave energy associated with the long fetch of Manalapan Lake. The additional native shoreline vegetation will stabilize the shoreline. In sections of shoreline where the erosion has resulted in steeper eroded conditions, coir logs have been proposed. The coir logs will be planted with native wetland vegetation ideally suited for the riparian location. In addition to stabilizing the shoreline and preventing further erosion of the lake shoreline, the project will also provide ecological, recreational and aesthetic benefits to Thompson Park. The material quantities and associated labor for the proposed design plans for station #37 were used to calculate a construction cost estimate of $20,000 for the project.

Property Access and Ownership

Thompson Park is owned by Middlesex County. The park is operated by the Middlesex County Department of Parks and Recreation. This portion of the park is located on Block 59, Lot 3 in Monroe Township. Potential property access for project implementation should be arranged through Middlesex County in cooperation with the Middlesex County Department of Parks and Recreation.

Project Permitting

The implementation of this project will require a significant amount of permitting due to its riparian location. This guidance document has been prepared to summarize the anticipated permitting requirements and thereby streamline the permitting process. This permitting information is current as of the preparation of this document but is subject to potential changes in state regulations depending on the actual implementation date of the project. The permitting for the project includes considerations for various state regulations including Flood Hazard Area and Freshwater Wetlands. The project will also require minimal permitting through the Freehold Soil Conservation District. Project-specific details related to each of these items are further described in the following sections.

Flood Hazard Area Regulations

The Flood Hazard Area Control Act Rules detail the requirements for any disturbance in riparian areas. Areas regulated under these rules include the riparian zone and the flood hazard area which includes the flood fringe and floodway.

The NJDEP surface water quality standards (N.J.A.C. 7:9) designate Manalapan Brook as a FW2-NT waterway, a freshwater stream which does not support trout production or trout maintenance. The project site is located in an outcrop of the Magothy formation. The Magothy formation is identified by the state as an area which is likely to contain acid producing soils. Therefore in accordance with N.J.A.C. 7:13-4.1(a)2 and N.J.A.C. 7:13-4.1(c)2.iv, the riparian zone in this area is defined as the area contained within a 150 foot buffer from the normal water surface limit of the lake.

Manalapan Brook is a NJDEP delineated waterway as described in N.J.A.C. 7:13-3.3. Therefore the flood hazard elevation (design flood elevation) is dictated by NJDEP adopted flood profiles and the floodway is identified as depicted on the NJDEP adopted flood maps.

The flood profile indicates that the flood hazard elevation is 52.9 feet (NGVD 1929) at the project location on Manalapan Lake. This translates to an elevation of 51.8 in the datum of the survey (NAVD 1988). The flood map indicates that along the western half of the project the floodway is consistent with the flood hazard area. In this area there is no flood fringe. Along the eastern half of the project shoreline the floodway is not consistent with the flood hazard area and a defined flood fringe exists between the flood hazard area boundary and the floodway. These regulatory areas have been shown on the plans based on interpretations made from the relevant NJDEP delineation and supporting documents.

Regulated activities include the “alteration of topography through excavation, grading and/or placement of fill”. They also include the construction or placement of any structure. The topographic changes outlined in the design plans and the installation of coir logs meets the definition of a regulated activity. Therefore, these activities are regulated under the Flood Hazard Area rules. Many of the activities proposed in this project are not applicable to any of the general permits listed in N.J.A.C. 7:13-8. Therefore, the project as a whole is not applicable to a general permit.

The entire project area is within the regulated riparian zone. Furthermore, portions of the project area are within the flood fringe *and* floodway. The activities necessary to stabilize the shoreline are considered regulated activities which entail a minimal amount of fill and the installation of coir logs. N.J.A.C. 7:13-10.3 lists the requirements for all regulated activities in a floodway. This section states that no fill and no other activity that would increase the ground surface elevation are permitted in the floodway. Consequently, a hardship exception for an individual permit will be required for the project implementation. The project meets the requirements set forth in N.J.A.C. 7:13-9.8 for the

NJDEP to issue a hardship exception for an individual permit. These requirements must include one of the following:

1. The Department determines that there is no feasible and prudent alternative to the proposed project, including not pursuing the project, which would avoid or substantially reduce the anticipated adverse effects of the project, and that granting the hardship exception would not compromise the reasonable requirements of public health, safety and welfare, or the environment;
2. The Department determines that the cost of compliance with the requirements of this chapter is unreasonably high in relation to the environmental benefits that would be achieved by compliance; and/or
3. The Department and applicant agree to one or more alternative requirements that, in the judgment of the Department, provide equal or better protection to public health, safety and welfare and the environment.

As further detailed in N.J.A.C. 7:13-9.8, all of the following requirements must be satisfied:

1. Due to an extraordinary situation of the applicant or site condition, compliance with this chapter would result in an exceptional and/or undue hardship for the applicant;
2. The proposed activities will not adversely affect the use of contiguous or nearby property;
3. The proposed activities will not pose a threat to the environment, or to public health, safety and welfare; and
4. The hardship was not created by any action or inaction of the applicant or its agents.

Finally, the application for the hardship exception individual permit must include the following:

1. A description of any potential impacts of the proposed project upon the environment;
2. If the hardship exception request relates to the access requirements of N.J.A.C. 7:13-11.6, proposed access routes to and from the property during a flood;
3. If the hardship exception request relates to any potential impacts from or to flooding, the projected height, velocity and duration of the floodwaters expected at the site during the flood hazard area design flood, as well as evidence that the project will not adversely affect the hydraulic capacity of any water so as to cause or increase flooding upstream and/or downstream of the proposed project;
4. If the hardship exception request is based on economic grounds, detailed financial documentation to support the request;
5. A description of the existing development in the area and any potential impacts of the proposed regulated activities on that development; and

6. Any additional information that the Department determines is reasonable and necessary to evaluate whether the hardship exception request meets the requirements of this section.

Similar to more standard individual permit applications, the application package must include a completed FHA checklist, application report, engineering report, environmental report (3 copies), proof of public notice in accordance with N.J.A.C. 7:13-16, and six (6) sets of design drawings.

Based on the unique project characteristics and its restoration-based objectives a "one-stop" permitting meeting should be coordinated with the NJDEP.

The state fees associated with the Flood Hazard Area rules will include a $500 fee for the flood hazard area delineation verification per N.J.A.C. 7:13-6, and a $4,000 fee for the hardship exception. Depending on the source of the funding, these fees may be waived by the NJDEP. Consulting fees associated with the preparation of the application package are estimated at $6,000.

Freshwater Wetlands Permitting

This project involves work along the lake shoreline State Open Water. Additionally, portions of this shoreline *may* be identified as wetlands. Therefore, an application for approval under the Freshwater Wetlands Protection Act Rules, N.J.A.C. 7:7A must be submitted to the NJDEP's Land Use Regulation Program (LURP). Any potential wetlands delineated at the site will likely be of ordinary value and therefore not have a transition area associated with them.

The rules have general permits that allow similar activities throughout the state to be conducted as long as specific conditions are met. For shoreline stabilization work, N.J.A.C. 7:7A provides a permit identified as a Freshwater Wetlands Statewide General Permit No. 20, Bank Stabilization (GP-20). The conditions of this permit allow for the permanent disturbance of State Open Waters with the following general limitations:

1. 150 linear feet for rip-rap;
2. 300 linear feet for soil bioengineering; or
3. 500 linear feet if the work is funded by the Division of Watershed Management.

There is no limit on vegetative stabilization measures for bank stabilization as set forth in Chapter 16 of the NRCS Engineering Field Handbook as referenced in N.J.A.C. 7:7. This project proposes a total of 146 linear feet of coir logs and a total of 348 linear feet (including coir logs) of total stabilization.

The review of the application includes a determination of whether or not there are negative impacts to state or federal threatened or endangered species, and impacts to

structures or features of historic significance. Neither of which are anticipated at this project location.

An application for a GP-20, as in all Freshwater Wetlands permits, will require public notice to all property owners within 200 feet of the project area or property and notification to the municipality and county where the project resides. A copy of the permit application must be submitted to the municipality's clerk to allow review by the public. Additionally, a LURP-2 application form will be required for project permitting.

The fees associated with the Freshwater Wetlands permitting include a $600 letter of interpretation review fee plus an additional $84 per project area acre ($84 for this project, less than one acre). Additionally, there is a general permit application fee of $600. Depending on the funding source for the project implementation, these fees may potentially be waived by the NJDEP. The estimated cost for the delineation and all supporting paperwork and permit applications is $2,700.

Soil Erosion and Sediment Control

The project is located within Middlesex County, so the Freehold Soil Conservation District will take jurisdiction for this project. Under the purview of the Soil Erosion and Sediment Control Act of 1975 (N.J.S.A. 4:24-39 and N.J.A.C. 2:90-1.1), a project that disturbs greater than 5,000 square feet of land area must apply to the county soil conservation district for a soil erosion and sediment control plan approval; however, the total disturbance of the project has been maintained below 5,000 square feet. Therefore, only an exemption application form is required to be submitted to the Freehold Soil Conservation District. There is no fee associated with this application.

Division of Fish and Wildlife

The Division of Fish and Wildlife will have a role in the review of the in-stream (lake) work. They will provide comment during the Freshwater Wetlands application process. During the LURP general permit review, the Division of Fish and Wildlife will review the impacts to the fisheries within the lake, as well as to downstream water resources.

While typical gamefish will likely not be an issue for this project, an additional timing restriction may be imposed. This potential timing restriction would require that work not be performed between May 1 and June 30. The purpose of this potential timing restriction would be to prevent disruption to fish spawning activities in the lake which occur during this time period. It is highly unlikely that a timing restriction would be imposed for a project of this nature. No lake lowering is required for project implementation.

Hydrologic Calculations

Due to the project's lake shoreline location, the project does not experience significant shear stress from flow in the 800 foot wide section of Manalapan Lake. To confirm this assumption the peak flow rate from the July 2005 storm, as recorded on the Spotswood

stream gage, was used to calculate the average velocity in Manalapan Lake. The peak flow rate is the highest flow rate recorded in the 50 year history of the gage. This is a conservative flow rate as it was measured at a downstream location with a significantly larger drainage area. This flow rate would result in an average velocity of only 0.4 feet per second (fps) in the section of Manalapan Lake where the project is proposed. Velocities along the shoreline are expected to be significantly lower than this average cross sectional flow rate. The stabilization measures proposed can easily withstand such lower velocities. This further confirms that the source of the erosion is primarily due to wind-driven wave action and Canada geese and not a result of shear stress from stream flow in Manalapan Lake.

Operation and Maintenance

The long-term operation and maintenance requirements for this design project are minimal. The most critical and the majority of the operation and maintenance requirements will occur during the first year or two following project implementation.

The design plan requires the installation of water fowl exclusion measures to prevent Canada goose herbivory of the recently planted vegetation. Once fully established following the first full growing season, the water fowl exclusion measures should no longer be required; however, during the first year this exclusion fencing should be monitored on a daily basis to ensure proper protection of the recently planted vegetation. This maintenance may include the repair or installation of additional stakes, fencing, or flagging.

Deer browsing is not expected to be a significant problem; however, the project should be monitored to determine if any deer browsing is occurring. The proposed water fowl exclusion measures may be successful in deterring deer; however, additional fencing may be required if deer frequent the project site.

Long-term operation and maintenance of the project will include the observation of the vegetation at the site to ensure that all the proposed plants become successfully established. During their initial establishment period (1-2 years), the shoreline should be inspected for signs of erosion. Localized erosion features should be repaired and reseeded and immediately protected with additional erosion control blankets.

During initial establishment, and continued thereafter, the project should be monitored for invasive plant species. Based on observations within the watershed this may include Japanese knotweed (*Polygonum cuspidatum*), common reed (*Phragmites australis*), mugwort (*Artemisia vulgaris*), and multiflora rose (*Rosa multiflora*). Frequent monitoring of the project for these and other potential invasive plants during the initial establishment period (1-2 years) will significantly reduce the propensity of the project to become established with these invasive and less-desirable species.

The project should also be periodically inspected to ensure that the use of this portion of the park by park visitors is not overly encumbered by the project. Slight modifications to the project may be required if it is determined that the success of project is being compromised by the visitors, or that the visitor's use of the park is being significantly encumbered by the project.

Specifications

The organization that bids and contracts this project for construction should attach their construction specifications document and any other bid documents required by their contracting staff. Each organization's requirements for specifications and bid documents will be different. Much of the specific information that must be referenced in those documents is contained on the plan sheets and can be inserted into an organization-specific set of specifications. A sample table of contents which outlines many of the basic specifications that will likely be required for this for this project is included below. Sample text for Erosion and Sediment Control is included within this Sample Table of Contents to provide an example of the information that would be included within project specifications.

SAMPLE TABLE OF CONTENTS

Section 011000 – Summary

Section 012500 – Substitution Procedures

Section 013233 – Photographic Documentation

Section 015000 – Temporary Facilities and Controls

Section 015500 – Construction access and parking

Section 015626 – Temporary Fencing

Section 015639 – Temporary Tree and Plant Protection

Section 015719 – Environmental protection

Section 017113 – Mobilization & demobilization

Section 017300 – Execution

Section 017700 – Closeout procedures

Section 024119 – Selective structure demolition/removal

Section 311413 – Soil stripping and stockpiling

Section 312000 – Earth moving

Section 312319 – Dewatering

Section 312500 – Soil erosion and sediment control

This work shall consist of installing and maintaining silt fence, haybales, stabilized construction entrance, turbidity barrier and temporary stabilization, as depicted and specified on the project plans.

1. REFER TO STANDARDS FOR SOIL EROSION AND SEDIMENT CONTROL IN NEW JERSEY. The Contractor shall conduct the work at all times in compliance with the requirements of the *Soil Erosion and Sediment Control Plan* as approved by the Freehold Soil Conservation District.
2. Full responsibility for care of water from whatever source including stream, direct rainfall, surface runoff, construction operations and any other sources out of the assigned work areas, shall be borne by the Contractor. The Contractor shall investigate and determine existing and anticipated conditions concerning care of water.
3. Water to be disposed of shall be discharged into existing drainage courses in a manner which will maintain natural surroundings unaltered, and will not hamper or damage the completed work in place or under construction.

Section 313219 – Geosynthetic soil stabilization

Section 329100 – Planting preparation

Section 329200 – Turf and grasses

Section 329300 – Plants

Section 354200 – Waterway Bank Protection

DESIGN PROJECT DOCUMENT FOR STREAMBANK STABILIZATION AND FLOODPLAIN RESTORATION ON AN UNNAMED TRIBUTARY OF MANALAPAN BROOK STATION #48 MONROE TOWNSHIP

Middlesex County, New Jersey

Prepared for:

New Jersey Water Supply Authority, on behalf of the
Manalapan Brook Watershed Restoration and
Protection Plan Project Committee
Watershed Protection Programs
74 East Main Street
Somerville, New Jersey 08876-2312
(P) 908.685.0315 • (F) 908.685.0195
Email: khale@raritanbasin.org

Prepared by:

Princeton Hydro, LLC

120 East Uwchlan Avenue, Suite 204
Exton, Pennsylvania 19341
(P) 610.524.4220 • (F) 610.524.9434
Email: flubnow@princetonhydro.com

February 2011

Introduction and Project Description

The Streambank Stabilization and Floodplain Restoration project is located along an unnamed tributary of Manalapan Brook at station #48. The channel in this location has steep eroding banks and is significantly entrenched. The project entails the creation of a stable stream channel through the use of various soil bioengineering techniques. The project also creates a functional floodplain to reduce velocity and resulting shear stress in the channel. The proposed bioengineering techniques used by the project include the implementation of live fascines, live stakes, boulder toe protection and additional vegetation.

The material quantities and associated labor for the proposed design plans for station #48 were used to calculate a construction cost estimate of $74,000 for the project. Project permitting fees are also discussed later in this document.

At the time of the creation of the design plans for station #48, the existing corrugated metal pipe culvert under Monroe Boulevard (upstream of the project reach) was in the design stage for replacement. The culvert is showing signs of distress and the asphalt along Monroe Boulevard was showing distress due to the condition of the culvert. The culvert is dedicated as #5C81 by Middlesex County. Based on correspondence with Middlesex County, the culvert is being designed by Delaware Raritan Engineering. An attempt was made to coordinate the design of the station #48 project with the replacement of the culvert. A written information request was sent to the Middlesex County Engineering Department on October 4th 2010. The request asked for any additional topographic or design information which may become available. It is assumed that the design of the culvert replacement was still ongoing, as no information was received. Therefore, these design plans were not available from the county at the completion of the design plans (February, 2011) for the streambank stabilization. The implementation of these plans should be coordinated such that it does not interfere with the culvert replacement. If the culvert replacement occurs prior to the implementation of this project, the current plans should be reevaluated to ensure that any potential topographic changes resulting from the culvert replacement do not interfere with the design project plans. Furthermore, the ownership/usage of the utility pole on the north side of the stream should be determined. Upon inspection, the pole appeared to only partially support abandoned phone or cable lines.

Property Access and Ownership

The subject stream reach is located on Block 23, Lot 21.02 in Monroe Township. The total lot area is 43.3 acres. Middlesex County Planning Department identified the property owners as Jacqueline and Gabrielle Dujue of 906A Kingston Terrace Drive in Princeton, NJ. The Middlesex County Planning Department also indicated that the property owners were contacted and were interested allowing access to their property for the purpose of implementing this design project. The design plans propose two points of access for the project, including one directly to Monroe Boulevard and one from the existing private driveway along the left side of the stream.

Project Permitting

The implementation of this project will require a significant amount of permitting due to its riparian location. This guidance document has been prepared to summarize the anticipated permitting requirements and thereby streamline the permitting process. This permitting information is current as of the preparation of this document but is subject to potential changes in state regulations depending on the actual implementation date of the project. Project specific details related to all potential permitting agencies are further described in the following sections.

Flood Hazard Area Regulations

The Flood Hazard Area Control Act Rules detail the requirements for any disturbance in riparian areas. Areas regulated under these rules include the riparian zone and the flood hazard area which includes the flood fringe and floodway.

The NJDEP surface water quality standards (N.J.A.C. 7:9) designate Manalapan Brook as a FW2-NT waterway, a freshwater stream which does not support trout production or trout maintenance. The project site is located in an outcrop of the Woodbury formation. The Woodbury formation is identified by the state as an area containing acid producing soils. Therefore, in accordance with N.J.A.C. 7:13-4.1 the riparian zone in this area is defined as the area contained within a 150 foot buffer from the top of bank of the stream.

In New Jersey, all work within regulated flood hazard areas is subject to the requirements contained in N.J.A.C. 7:13. Since the project lies within the flood hazard area of an unnamed tributary to the Manalapan Brook, a flood hazard area verification (see N.J.A.C. 7:13-3.2) and individual permit will be required. Preliminarily, it appears that the site is mapped with a delineated floodplain by FEMA. As such, a method 3 determination may be applicable. Should the NJDEP require that the floodway be analyzed or detailed hydraulic calculations be performed for the work, a method 4 determination may be necessary.

The proposed project will be subject to the requirements of N.J.A.C. 7:13-11.14 for the bank stabilization and channel restoration. In addition, based on the anticipated disturbance limits within the 150 foot riparian zone a hardship exception may be required. The rules allow for a maximum permanent disturbance of 2,000 square feet and a temporary disturbance of 6,000 square feet, and the project has a total of 8,993 square feet of temporary disturbance. Based on the unique project characteristics and its restoration-based objectives a “one-stop” permitting meeting should be coordinated with the NJDEP.

The project meets the requirements set forth in N.J.A.C. 7:13-9.8 for the NJDEP to issue a hardship exception for an individual permit. These requirements must include one of the following:

1. The Department determines that there is no feasible and prudent alternative to the proposed project, including not pursuing the project, which would avoid or substantially reduce the anticipated adverse effects of the project, and that granting the hardship exception would not compromise the reasonable requirements of public health, safety and welfare, or the environment;
2. The Department determines that the cost of compliance with the requirements of this chapter is unreasonably high in relation to the environmental benefits that would be achieved by compliance; and/or
3. The Department and applicant agree to one or more alternative requirements that, in the judgment of the Department, provide equal or better protection to public health, safety and welfare and the environment.

As further detailed in N.J.A.C. 7:13-9.8, all of the following requirements must be satisfied:

1. Due to an extraordinary situation of the applicant or site condition, compliance with this chapter would result in an exceptional and/or undue hardship for the applicant;
2. The proposed activities will not adversely affect the use of contiguous or nearby property;
3. The proposed activities will not pose a threat to the environment, or to public health, safety and welfare; and
4. The hardship was not created by any action or inaction of the applicant or its agents.

Finally, the application for the hardship exception individual permit must include the following:

1. A description of any potential impacts of the proposed project upon the environment;
2. If the hardship exception request relates to the access requirements of N.J.A.C. 7:13-11.6, proposed access routes to and from the property during a flood;
3. If the hardship exception request relates to any potential impacts from or to flooding, the projected height, velocity and duration of the floodwaters expected at the site during the flood hazard area design flood, as well as evidence that the project will not adversely affect the hydraulic capacity of any water so as to cause or increase flooding upstream and/or downstream of the proposed project;
4. If the hardship exception request is based on economic grounds, detailed financial documentation to support the request;
5. A description of the existing development in the area and any potential impacts of the proposed regulated activities on that development; and
6. Any additional information that the Department determines is reasonable and necessary to evaluate whether the hardship exception request meets the requirements of this section.

Similar to more standard individual permit applications, the application package must include a completed FHA checklist, application report, engineering report, environmental report (3 copies), proof of public notice in accordance with N.J.A.C. 7:13-16, and six (6) sets of design drawings. The permit is always conditioned on receiving all other required approvals.

The state fees associated with the Flood Hazard Area rules will include a $500 (method 3) or $3,000 plus $30 per 100 linear feet of channel (method 4, $60 for this project) fee for the flood hazard area delineation verification per N.J.A.C. 7:13-6, and a $4,000 fee for the hardship exception. Depending on the source of the funding these fees may be waived by the NJDEP. Consulting fees associated with the preparation of the application package are estimated at $10,000.

Freshwater Wetlands Permitting

This project involves work along the stream and in State Open Water. Additionally, portions of this shoreline will likely be identified as wetlands. Therefore, an application for approval under the Freshwater Wetlands Protection Act Rules, N.J.A.C. 7:7A must be submitted to the NJDEP's Land Use Regulation Program (LURP). Any potential wetlands delineated at the site will likely be of ordinary value and therefore not have a transition area associated with them.

The rules have general permits that allow similar activities throughout the state to be conducted as long as specific conditions are met. For shoreline stabilization work, N.J.A.C. 7:7A provides a permit identified as a Freshwater Wetlands Statewide General Permit No. 20, Bank Stabilization (GP-20). The conditions of this permit allow for the permanent disturbance of State Open Waters with the following general limitations:

1. 150 linear feet for rip-rap
2. 300 linear feet for soil bioengineering, or
3. 500 linear feet if the work is funded by the Division of Watershed Management.

There is no limit on vegetative stabilization measures for bank stabilization as set forth in N.J.A.C. 7:7A. The combination of different approaches (rip-rap, bioengineering, etc) is also permitted as long as each approach is kept within its allowable limit.

The review of the application includes a determination of whether or not there are negative impacts to state or federal threatened or endangered species, and impacts to structures or features of historic significance. Neither of these impacts are anticipated at this project location.

An application for a GP-20, as in all Freshwater Wetlands permits will require public notice to all property owners within 200 feet of the project area or property and notification to the municipality and county where the project resides. A copy of the

permit application must be submitted to the municipality's clerk to allow review by the public.

The fees associated with the Freshwater Wetlands permitting include a $600 letter of interpretation review fee plus an additional $84 per project area acre. Additionally, there is a general permit application fee of $600. Depending on the funding source for the project implementation, these fees may potentially be waived by the NJDEP. Consulting fees associated with the preparation of the application package are estimated at $4,000.

Soil Erosion and Sediment Control

The project is located within Middlesex County, so the Freehold Soil Conservation District will take jurisdiction for this project. Under the purview of the Soil Erosion and Sediment Control Act of 1975 (N.J.S.A. 4:24-39 and N.J.A.C. 2:90-1.1), a project that disturbs greater than 5,000 square feet of land area must apply to the county soil conservation district for a soil erosion and sediment control plan approval. This project exceeds the 5,000 square foot threshold, therefore the project will require a soil erosion and sediment control plan certification. A fee of $890 is expected in accordance with the Freehold Soil Conservation District fee schedule. Three (3) copies of the plan set must be submitted along with the application fee.

Division of Fish and Wildlife

The Division of Fish and Wildlife will have a role in the review of the in-stream work. They will provide comment during the Freshwater Wetlands application process. During the LURP general permit review, the Division of Fish and Wildlife will review the impacts to the fisheries within the stream, as well as to downstream water resources.

While general gamefish will likely not be an issue for this project, an additional timing restriction may be imposed. This potential timing restriction would require that work not be performed between May 1 and June 30 to avoid interfering with spawning activities. Due to the size and type of waterway it is highly unlikely that a timing restriction would be required.

Local Approvals

While the proposed bank stabilization work does not disturb a large sediment volume, it is worth noting that Monroe Township requires soil disturbance approvals that may apply if more than 500 cubic yards of material are to be removed from the project site.

Hydrologic Calculations

This reach of the Unnamed Tributary to Manalapan Brook is ungaged, and has not been previously studied by the state. Therefore, hydrologic data for the subject reach was determined through the use of USGS StreamStats online analysis for New Jersey. This analysis provides the user with estimated peak stream discharge for various statistics, e.g. two-year peak flow, 25-year peak flow, etc. The 1.19 square mile (762 acre) drainage

area was delineated using the automated USGS StreamStats analysis, and predicted discharges were utilized for additional hydraulic analysis described below. With inherent prediction errors (unknown in this case) associated with the USGS StreamStats analysis, a degree of conservatism was incorporated in the final design. Full hydrologic modeling was beyond the scope of the project; however, the upstream culvert replacement likely requires such an analysis. Following design of the culvert replacement (by others), hydrologic calculations here-in should be re-visited and compared to culvert design to verify consistency. The results of the hydrologic calculations are attached.

In conjunction with the hydrologic data as described above, simplified hydraulic calculations were then performed utilizing Manning's equation. These calculations were performed at a cross-section of interest within the subject reach (identified on the associated design plans). Results of the Manning's equation were reviewed in conjunction with a host of other hydraulic variables, including velocity, shear stress, flow area, etc., and utilized for design of stabilization measures. Results of hydraulic calculations are attached to this report.

For the subject reach, estimated average velocities and shear stresses were examined to determine appropriate stabilization measures (e.g. vegetation, vegetated erosion control matting, riprap, etc.). Although estimated average velocities/shear stresses through this reach only slightly exceed recommended allowable ranges for vegetation alone, as a conservative measure to account for potential localized instantaneous peak velocities/shear stresses, and lend confidence in the overall stability of the proposed project, erosion control matting and boulder toe protection are proposed where noted on the associated design plans. Calculated average velocities and shear stresses are well within the range of permissible values for proposed erosion control matting, live fascines, and boulder toe protection, as proposed for the floodplain bench and adjacent banks. Proposed conditions allow flow on the floodplain bench at approximately the 10-month discharge; where under existing conditions, flows exceeding the five-year event are contained entirely within the channel. Further, as shown in the attached appendices, the proposed cross-section geometry with floodplain bench and stabilization measures provides for increased cross-sectional area for all water surface elevations above the floodplain bench elevation, resulting in reduced velocities and shear stresses for any given discharge rate. As such, it is our professional opinion that the proposed stabilization measures and floodplain bench creation will provide for less erosion potential, and subsequently less sediment input to the Manalapan Brook system.

As discussed above, the anticipated replacement of the Monroe Boulevard culvert (by others) at the upstream end of the subject reach (identified by Middlesex County as #5C81), is critical to the long term stability of the proposed stabilization, specifically within the downstream zone of influence of the culvert. Data suggests the existing culvert can only convey between the two- and five-year discharge at full capacity. Estimated velocities in the existing undersized culvert approach 9-10 feet per second (fps), at full capacity, and when combined with overtopping flow, are consistent with observed

existing erosion patterns. To mitigate pressure flow and erosive peak velocities at the culvert, any replacement culvert should have a minimum capacity of 440 cubic feet per second (cfs) (FHA = 100-year + 25%), based on estimated hydrologic calculations. Additionally, while not specifically required in NJ, it is recommended that the minimum open area of 24-27 sq ft, and a minimum width of 12-15 ft (1.2 x bankfull width) be provided for in the proposed design to reduce outflow velocities and overall erosion potential, and increase stream continuity/connectivity through the reach of interest. These recommendations are consistent with stream simulation guidance in place in other States throughout the Northeast (MA, VT, CT, NH), as well as regulatory requirements in other United States Army Corps of Engineers (USACE) districts.

Operation and Maintenance

Some mortality is expected for planted trees, shrubs and live stakes. Deer browse is the most prominent threat to plant survivorship; the site should be inspected within one month of plant installation to ensure that deer herbivory protection measures are in-place and functioning. Additional deer herbivory protection measures may also be needed such as scent- or noise-based deterrents, or electrical fencing. Over the long-term, the site should be monitored periodically for up to three years. If plant survivorship is low enough to threaten bank and floodplain stability, supplemental planting and deer protection measures should be considered.

Live stakes require specific care and strict adherence to the installation guidelines that are described on the plans. Live stakes should only be installed during the dormant season, between November 15th and March 1st. Outside of this window, live stakes should not be used. If conditions are abnormally dry, regular watering, approximately once a week for six weeks is imperative.

Only native plants have been chosen for the design project. Due to surrounding non-native plants and the presence of non-native seeds, emergence of non-native invasive plants in the planting area is somewhat expected. If non-native species threaten the native plantings, manual removal of non-natives should be considered.

Bank stabilization measures should be inspected after the first high flow events (bankfull or larger) following installation. Erosion control fabric, which may be peeled or dislodged, should be inspected and restaked or stapled as necessary. Fascines, which are to be staked to the bank, should be inspected and re-attached as necessary.

Specifications

The organization that bids and contracts this project for construction should attach their construction specifications document and any other bid documents required by their contracting staff. Each organization's requirements for specifications and bid documents will be different. Much of the specific information that must be referenced in those documents is contained on the plan sheets and can be inserted into an organization-specific set of specifications. A sample table of contents which outlines many of the basic

specifications that will likely be required for this for this project is included below. Sample text for Erosion and Sediment Control is included within this Sample Table of Contents to provide an example of the information that would be included within project specifications.

SAMPLE TABLE OF CONTENTS

Section 011000 – Summary
Section 012500 – Substitution Procedures
Section 013233 – Photographic Documentation
Section 015000 – Temporary Facilities and Controls
Section 015626 – Temporary Fencing
Section 015639 – Temporary Tree and Plant Protection
Section 015719 – Environmental Protection
Section 017113 – Mobilization
Section 017300 – Execution
Section 017700 – Close out Procedures
Section 311100 – Clearing and Grubbing
Section 311413 – Soil Stripping and Stockpiling
Section 312200 – Grading
Section 312316 – Excavation
Section 312319 – Dewatering
Section 312500 – Soil Erosion and Sediment Control

This work shall consist of installing and maintaining silt fence, haybales, stabilized construction entrance, turbidity barrier and temporary stabilization, as depicted and specified on the project plans.

1. REFER TO STANDARDS FOR SOIL EROSION AND SEDIMENT CONTROL IN NEW JERSEY. The Contractor shall conduct the work at all times in compliance with the requirements of the *Soil Erosion and Sediment Control Plan* as approved by the Freehold Soil Conservation District.
2. Full responsibility for care of water from whatever source including stream, direct rainfall, surface runoff, construction operations and any other sources out of the assigned work areas, shall be borne by the Contractor. The Contractor shall investigate and determine existing and anticipated conditions concerning care of water.
3. Water to be disposed of shall be discharged into existing drainage courses in a manner which will maintain natural surroundings unaltered, and will not hamper or damage the completed work in place or under construction.

Section 321216 – Asphalt Paving (as necessary for pavement restoration)
Section 329200 – Turf and Grasses
Section 329300 – Plants
Section 354200 – Waterway Bank Protection

USGS New Jersey StreamStats

Basin Characteristics Report

Date: Fri Feb 4 2011 14:51:27 Mountain Standard Time
NAD27 Latitude: 40.3053 (40 18 19)
NAD27 Longitude: -74.4047 (-74 24 17)
NAD83 Latitude: 40.3054 (40 18 19)
NAD83 Longitude: -74.4043 (-74 24 15)

Parameter	Value
Drainage area in square miles	1.19
Percent of area covered by water and wetland.	50.4
Mean population density, people per square mile, 2000 census block data.	183
Slope along the flow path between points 10 and 85 percent of the length along the longest flow path determined by a GIS, in feet per mile	48.7
Total stream length in miles	4.72
Percent of area covered by forest	12.3
Percent of area covered by urban land use	19.2
Percent of area covered by wetland land use	49.8
Average basin elevation in feet	114

USGS New Jersey StreamStats

Streamstats Ungaged Site Report

Date: Fri Feb 4 2011 14:52:05 Mountain Standard Time
Site Location: New_Jersey
NAD27 Latitude: 40.3053 (40 18 19)
NAD27 Longitude: -74.4047 (-74 24 17)
NAD83 Latitude: 40.3054 (40 18 19)
NAD83 Longitude: -74.4043 (-74 24 15)
Drainage Area: 1.19 mi2

Peak Flows Region Basin Characteristics

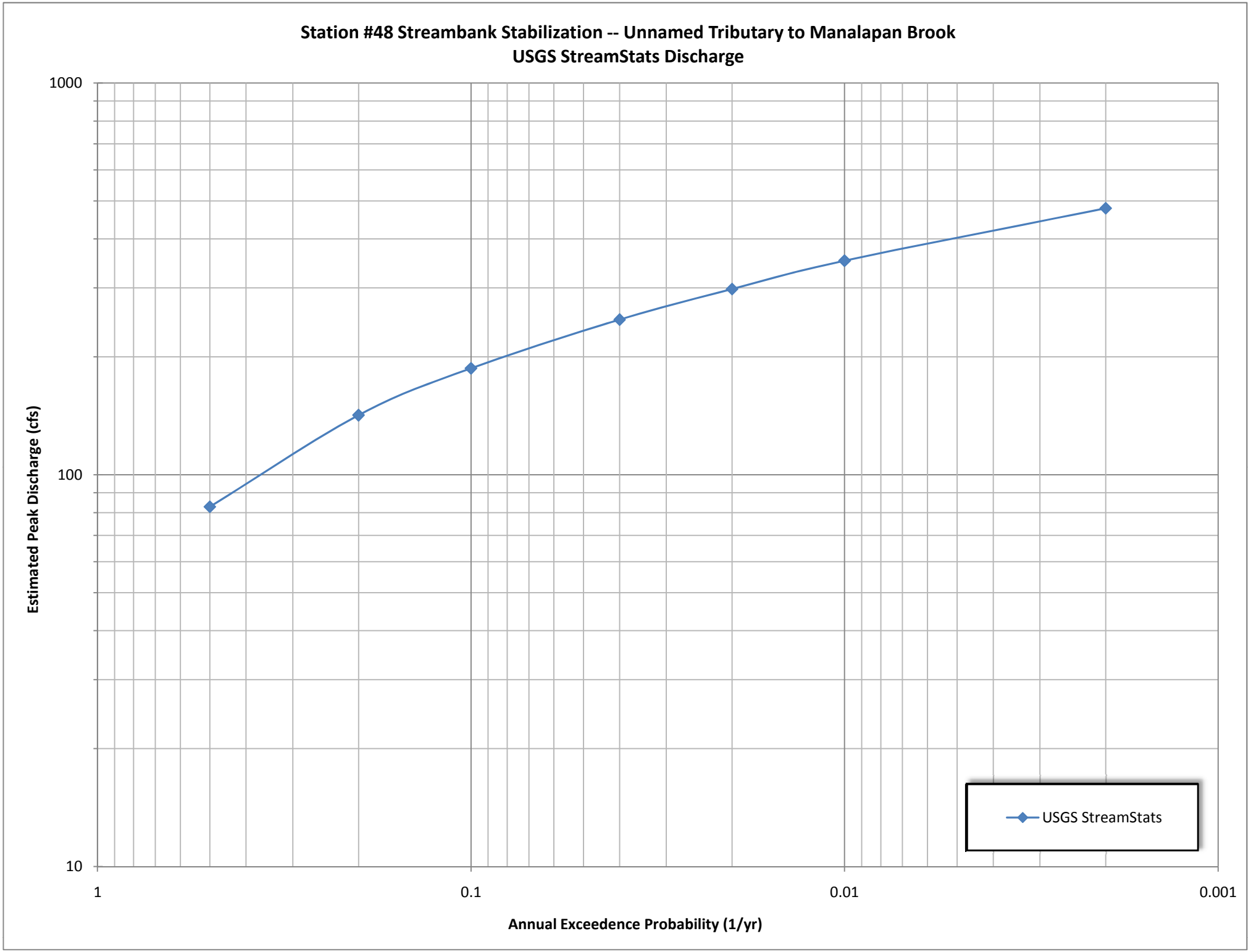
100% Peak Inner Coastal Region 2009 5167 (1.19 mi2)

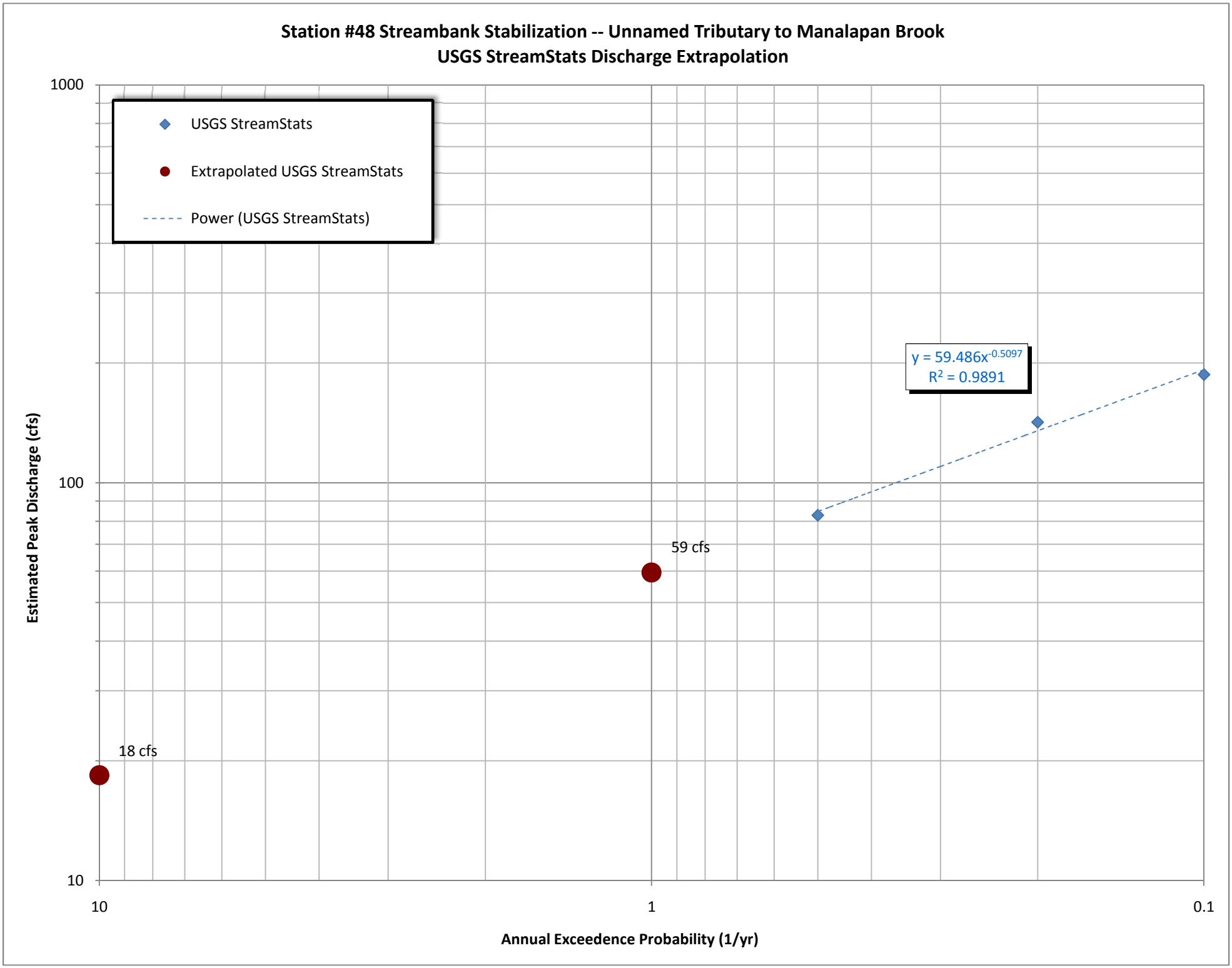
Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	1.19	0.41	118
Percent Storage (percent)	50.4 (above max value 41.1)	1	41.1
Stream Slope 10 and 85 Method (feet per mi)	48.7	2.49	55.5
Basin Population Density (persons per square mile)	183	34	5382

Warning: Some parameters are outside the suggested range. Estimates will be extrapolations with unknown errors.

Peak Flows Region Streamflow Statistics

Statistic	Flow (ft^3/s)	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
PK2	82.9		1		
PK5	142		2		
PK10	187		3		
PK25	249		4		
PK50	298		5		
PK100	352		5		
PK500	479		6		


Station #48 Streambank Stabilization -- Unnamed Tributary to Manalapan Brook
USGS StreamStats Discharge
1000
100
10
Estimated Peak Discharge (cfs)
1
0.1
0.01
0.001
Annual Exceedence Probability (1/yr)
USGS StreamStats


Station #48 Streambank Stabilization -- Unnamed Tributary to Manalapan Brook
USGS StreamStats Discharge Extrapolation
USGS StreamStats
Extrapolated USGS StreamStats
Power (USGS StreamStats)
y = 59.486x^-0.5097
R² = 0.9891
59 cfs
18 cfs
1000
100
10
10
1
0.1
Estimated Peak Discharge (cfs)
Annual Exceedence Probability (1/yr)

Station #48 Streambank Stabilization -- Unnamed Tributary to Manalapan Brook Hydrology Summary [1]			
Average Recurrence Interval (yr)	***Annual Exceedance Probabilty (%)***	***Annual Exceedance Probabilty (1/yr)***	***USGS StreamStats Peak Discharge (cfs)***
0.1	1000	10	18
1	100	1	59
2	50	0.5	83
5	20	0.2	142
10	10	0.1	187
25	4	0.04	249
50	2	0.02	298
100	1	0.01	352
500	0.2	0.002	479

[1] 2- through 500-yr ARI discharge obtained from USGS New Jersey StreamStats application. 0.1- and 1-yr ARI discharge extrapolated from data set.

Monroe Boulevard Culvert Crossing

Existing 24” H x 74” W CMP Culvert Capacity

Manning’s calculation*

Slope	= 0.0075 ft/ft	Hydr Radius	=	0.81
‘n' value	= 0.015	Area	=	8.30 sq.ft.
		Velocity	=	7.5 fps
		Capacity	=	61.97 cfs

Diameter = 39 in. (approximate equivalent size)
Depth of flow = 39.0 in.

* Assuming 2/3 of H x W for area to obtain approximate equivalent size.

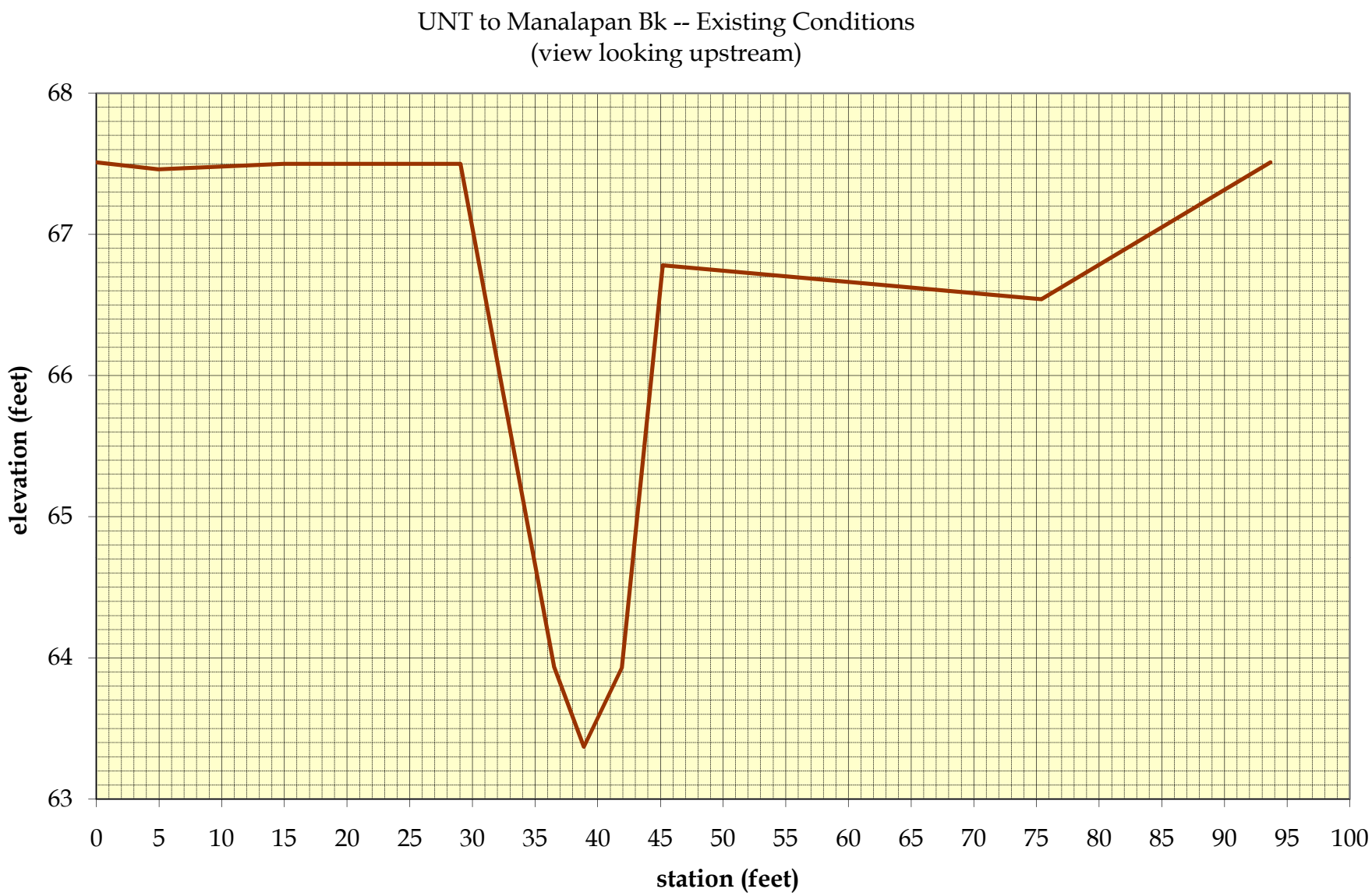
Manning’s calculation**

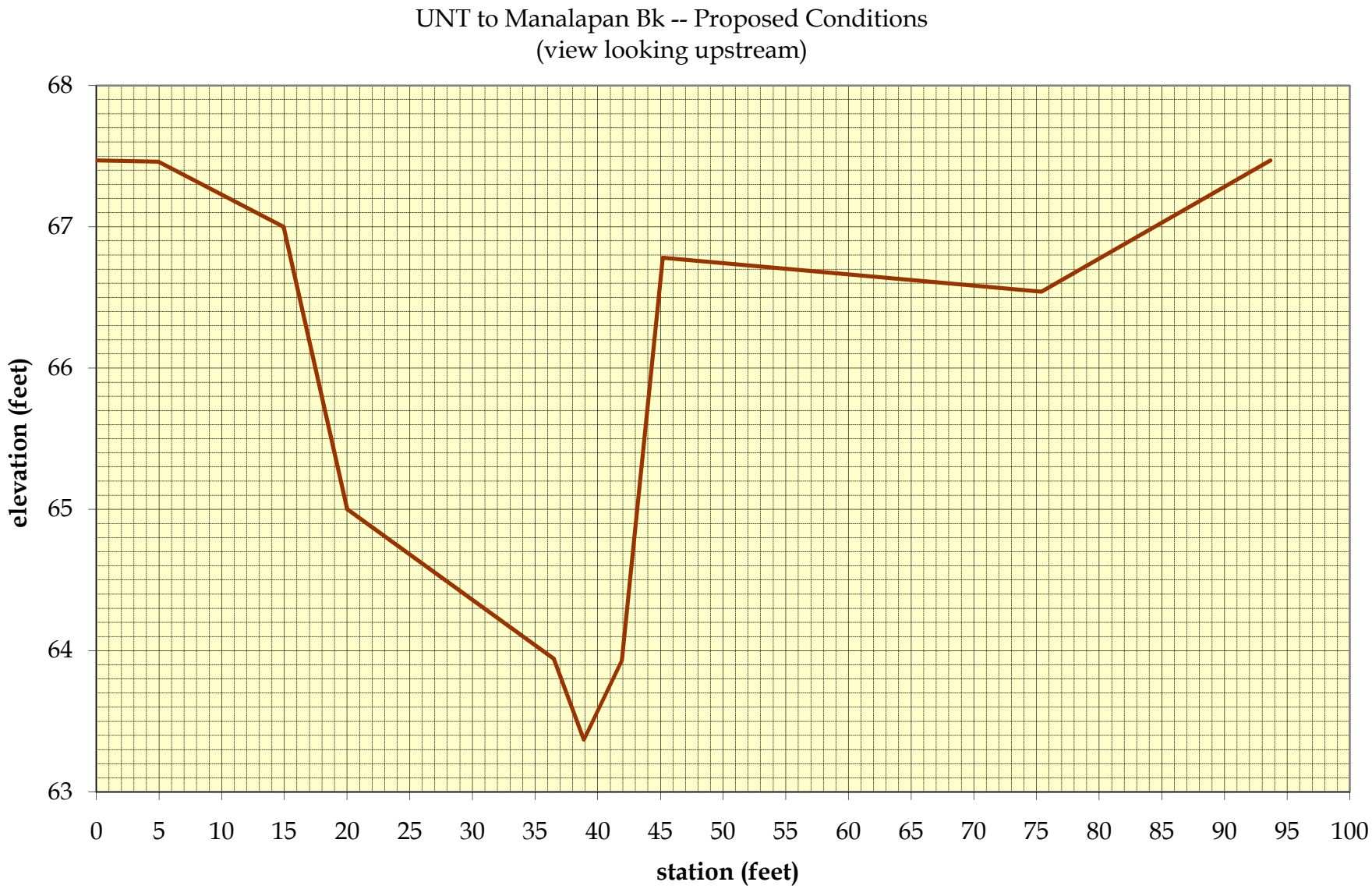
Slope	= 0.0075 ft/ft	Hydr Radius	=	1.00
‘n' value	= 0.015	Area	=	12.57 sq.ft.
		Velocity	=	8.6 fps
		Capacity	=	107.80 cfs

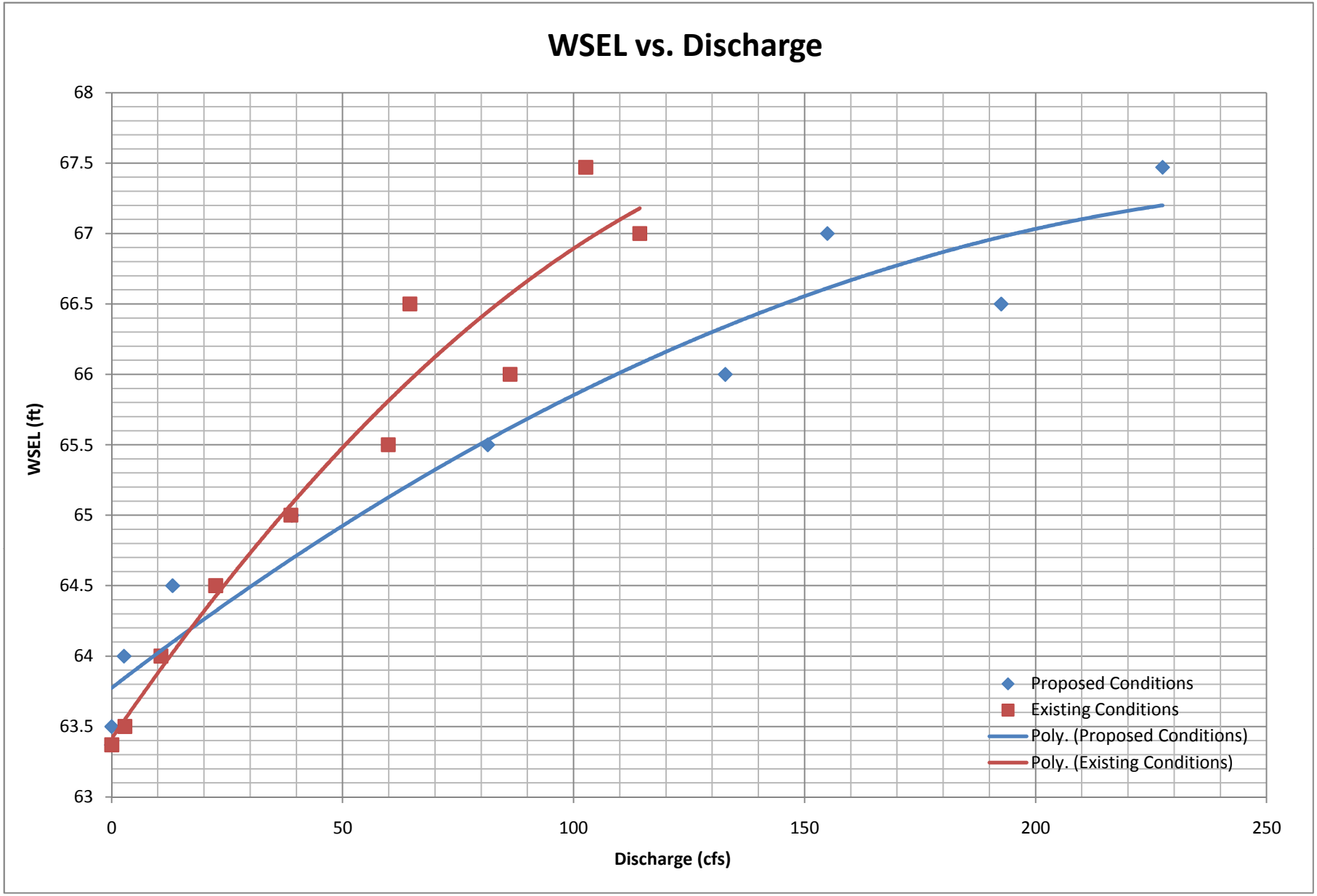
Diameter = 48.0 in. (approximate equivalent size)
Depth of flow = 48.0 in.

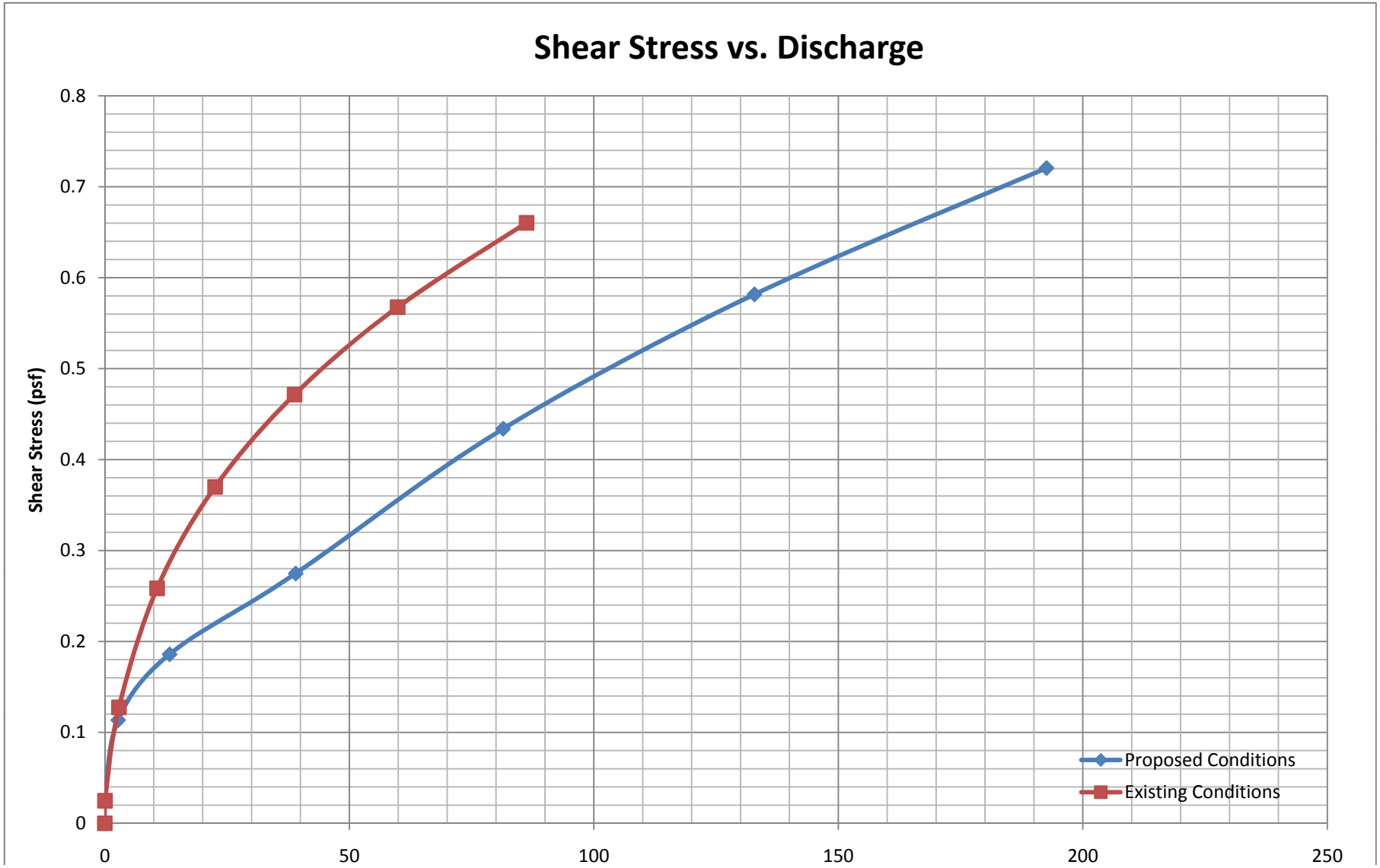
** Assuming full H x W for area to obtain approximate equivalent size.

Approximate capacity of existing pipe: ~60 – 110 cfs


UNT to Manalapan Bk -- Existing Conditions
(view looking upstream)
68
67
66
65
64
63
elevation (feet)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
station (feet)


UNT to Manalapan Bk -- Proposed Conditions
(view looking upstream)
elevation (feet)
68
67
66
65
64
63
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
station (feet)


WSEL vs. Discharge
WSEL (ft)
68
67.5
67
66.5
66
65.5
65
64.5
64
63.5
63
0
50
100
150
200
250
Discharge (cfs)
Proposed Conditions
Existing Conditions
Poly. (Proposed Conditions)
Poly. (Existing Conditions)


Shear Stress vs. Discharge
Shear Stress (psf)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
50
100
150
200
250
Proposed Conditions
Existing Conditions

New England District, U.S. Army Corps of Engineers, Regulatory Division
Openness Ratio Spreadsheet

- Openness Ratio (OR) is calculated by dividing a culvert's cross-sectional area by its length: OR = x-sec area ÷ length
- Along with other criteria, the MA PGP, General Condition 21, states that to qualify for the Category 1 (non-reporting):
  1. New permanent stream crossings must have an OR ≥.25

     $$OR = .25 = \frac{\text{(x-sec area)}}{\text{culvert length}} \quad \text{or} \quad OR = .25 = \frac{\text{[(x-sec culvert area pre-embed) - embedded area]}}{\text{culvert length}}$$

  2. Round culverts must be embedded at least 25%
- The chart below provides the diameter needed to meet the .25 OR for various culvert lengths, accounting for the embedded area, when embedding 25%. All calculations must be done in meters. The conversion to feet is provided.
- The Corps uses the .25 OR as a guide for Category 2 projects reviews.

Required Diameter for .25 OR & 25% Embedment					
Length		Required Open Area		Required Diameter	
(FT)	(M)	(FT^2)	(M^2)	(FT)	(M)
6	1.83	4.92	0.46	2.79	0.85
8	2.44	6.56	0.61	3.23	0.98
10	3.05	8.20	0.76	3.61	1.10
12	3.66	9.84	0.91	3.95	1.21
14	4.27	11.48	1.07	4.27	1.30
16	4.88	13.12	1.22	4.56	1.39
18	5.49	14.76	1.37	4.84	1.48
20	6.10	16.40	1.52	5.10	1.56
22	6.71	18.04	1.68	5.35	1.63
24	7.32	19.68	1.83	5.59	1.70
26	7.93	21.32	1.98	5.82	1.77
28	8.54	22.96	2.13	6.04	1.84
30	9.15	24.60	2.29	6.25	1.91
32	9.76	26.24	2.44	6.45	1.97
34	10.37	27.88	2.59	6.65	2.03
36	10.98	29.52	2.74	6.85	2.09
38	11.59	31.16	2.90	7.03	2.14
40	12.20	32.80	3.05	7.22	2.20
42	12.80	34.44	3.20	7.39	2.25
44	13.41	36.08	3.35	7.57	2.31
46	14.02	37.72	3.51	7.74	2.36
48	14.63	39.36	3.66	7.90	2.41
50	15.24	41.00	3.81	8.07	2.46

Recommended minimum cross-sectional area

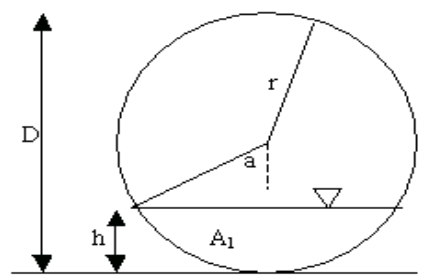
Derivation

1. The MA PGP, Category 1 requires:
   * 25% culvert embedment (=.25 x culvert diameter)
   * .25 openness ratio

2. Embedded area calculated as follows:

$$A_1 = \frac{D^2}{4}\left[a - \frac{\sin(2a)}{2}\right]$$

$$a = \cos^{-1}(1 - h/r)$$



Notes:
   * a is in radians
   * a = 60° = 1.05 radians, if h =.25D
   * A_1 = embedded area

3. $$OR = .25 = \frac{\text{[(x-sec culvert area pre-embed) - embedded area]}}{\text{culvert length}}$$

where:
   * x-sec area = $\Pi D^2 / 4$
   * embedded area for 25% embed = $.62D^2/4 = (A_1)$
   * culvert length = L

Therefore:

$$.25 = \frac{\Pi D^2/4 - .62D^2/4}{L}$$

or

$$D = .63L^{1/2}$$

1/4/2006

DESIGN PROJECT DOCUMENT FOR DRY DETENTION BASIN RETROFIT STATION #80 SWEETMANS LANE MANALAPAN TOWNSHIP

Monmouth County, New Jersey

Prepared for:

New Jersey Water Supply Authority, on behalf of the
Manalapan Brook Watershed Restoration and
Protection Plan Project Committee
Watershed Protection Programs
74 East Main Street
Somerville, New Jersey 08876-2312
(P) 908.685.0315 • (F) 908.685.0195
Email: khale@raritanbasin.org

Prepared by:

Princeton Hydro, LLC

120 East Uwchlan Avenue, Suite 204
Exton, Pennsylvania 19341
(P) 610.524.4220 • (F) 610.524.9434
Email: flubnow@princetonhydro.com

February 2011

Introduction and Project Description

The Dry Detention Basin Retrofit project is located in an existing detention basin in Manalapan Township. The design objective of this design project is to improve the water quality benefits of the basin by providing infiltration of stormwater runoff and also by improving the basin's removal of Total Suspended Solids (TSS).

The existing basin has two main inlets and three main concrete low flow channels which convey flow from the inlets directly to the outlet structure. The current configuration of the basin does not provide substantial TSS removal due to the lack of vegetation over the majority of the basin, and the directly connected concrete low flow channels.

The proposed design features include the removal of all of the concrete low flow channels, the creation of a forebays and stone filter berms at both inlets, the elongation of the flow path, a complete re-vegetation of the basin, and the creation of a large designated infiltration area within the basin.

Under the proposed conditions flows from smaller, more frequent storm events will have access to the entire basin, instead of being routed directly to the outlet structure. The flow path during these smaller events will be substantially lengthened under proposed conditions. This will maximize the runoff contact time with vegetation, decrease flow velocity and therefore promote the removal of TSS. Furthermore, the creation of a large designated infiltration area will provide direct infiltration of incoming stormwater runoff from the basin's main inlet. This infiltration will result in direct TSS removal and decrease downstream flow rates and durations which will decrease potential streambank erosion in downstream stream segments.

Infiltration is possible at this location based on the adequate separation from the groundwater table that was observed at the basin and the coarse-grained soils and acceptable hydraulic conductivity measurements made during an initial site investigation.

Ancillary benefits of the project include aesthetic improvements to the basin, largely due to the proposed addition of native vegetation in the basin. The proposed condition of the basin will minimize the need for the periodic mowing of the basin. The project will also greatly increase the ecological value of the basin. The design plans also propose a location for potential educational signage. The material quantities and associated labor for the proposed design plans for station #80 were used to calculate a construction cost estimate of $41,000 for the project.

Property Access and Ownership

The basin is located on Block 8303, Lot 18.01. Based on discussions with the Manalapan Township Engineer, the parcel is owned by Manalapan Township. Manalapan Township is responsible for maintenance and all other work within the basin. Potential access for project implementation will occur at the existing access location for the basin along the west side of Michael Lane.

Project Permitting

The implementation of this project will not require a significant amount of permitting. The following permitting guidance has been prepared to summarize the anticipated permitting requirements and thereby streamline the permitting process. This permitting information is current as of the preparation of this document but is subject to potential changes in state regulations depending on the actual implementation date of the project. Project specific details related to all potential permitting agencies are further described in the following sections.

Flood Hazard Area Regulations

The Flood Hazard Area Control Act Rules detail the requirements for any disturbance in riparian areas. Areas regulated under these rules include the riparian zone and the flood hazard area which includes the flood fringe and floodway.

The NJDEP surface water quality standards (N.J.A.C. 7:9) designate the nearby unnamed tributary of Manalapan Brook as a FW2-NT waterway, a freshwater stream which does not support trout production or trout maintenance. The project site is *not* located within a geologic outcrop identified by the state which contains acid producing soils. Therefore, in accordance with N.J.A.C. 7:13-4.1, the riparian zone in this area is defined as the area contained within a 50 foot buffer from the normal water surface limit of the adjacent pond as shown in the plan set. Based on the state flood hazard area mapping the basin is not located within the flood hazard area. Therefore, no regulated work is proposed within a regulated area and no flood hazard area permitting is required for the project. Consequently, there are no flood hazard area fees associated with the implementation of the project.

Freshwater Wetlands Permitting

This project involves a retrofit of a lawfully existing stormwater management basin. The basin was constructed in an uplands area. Therefore, it is unlikely that the state would consider any areas contained within the basin as jurisdictional wetlands or state open waters.

The adjacent pond will likely be considered state open water and may have jurisdictional wetland areas along the shoreline. Based on a review of the New Jersey Landscape data, it is unlikely that wetlands potentially delineated in these areas would be anything but ordinary in resource value. Ordinary resource value wetlands and state open water do not have any transition area associated with them. Therefore it is not likely that there would be any wetland transition areas within the area of the proposed work.

It is recommended that a wetlands delineation be conducted at the site to confirm that there are no jurisdictional wetlands or transition areas within the project area. The fees associated with the Freshwater Wetlands permitting include a $600 letter of interpretation

review fee plus an additional $84 per project area acre ($84 in this case). Depending on the funding source for the project implementation, these fees may potentially be waived by the NJDEP. The estimated cost for the delineation and all supporting paperwork is $2,500.

Soil Erosion and Sediment Control

The project is located within Monmouth County, therefore the Freehold Soil Conservation District will take jurisdiction for this project. Under the purview of the Soil Erosion and Sediment Control Act of 1975 (N.J.S.A. 4:24-39 and N.J.A.C. 2:90-1.1), a project that disturbs greater than 5,000 square feet of land area must apply to the county soil conservation district for a soil erosion and sediment control plan approval. The total disturbance area for this project is 41,477 square feet.

Since this project exceeds the 5,000 square foot threshold, the project will require a soil erosion and sediment control plan certification. A fee of $975 is expected in accordance with the Freehold Soil Conservation District fee schedule. Three copies of the plan set must be submitted along with the application fee.

Hydrologic Calculations

The detention basin collects stormwater runoff from the adjacent neighborhood which includes the residential areas along Michael Lane, Jerry Court, and Anne Court. Inflow is split between two separate inflow structures. The soils in the vicinity of the detention basin are primarily defined by a hydrologic soil group classification of 'B'.

A hydrologic model was created to calculate the peak flow rates and corresponding peak water surface elevations in the basin. The roughly 27 acre drainage area to the basin was split into sub areas to account for the two separate inlets to the basin. The Army Corps of Engineers HEC-HMS model was used for all hydraulic and hydrologic calculations. Time of concentration calculations were performed using the TR-55 methodology. Flows were routed through the basin using the Modified Puls methodology with geometry and outflow structure configurations based on the surveyed information. No modifications to the outlet structure are proposed for this project. Therefore basin's original peak flow performance during large design storms will not substantially differ between the pre and post retrofit conditions. The additional measures to encourage infiltration will provide a decrease in the peak flow rates under post retrofit conditions; however these differences will not be significant during the large infrequent design storms which the basin was originally designed for.

During the preliminary site investigation, two hand auger borings were progressed within the basin. The locations of these borings are shown on the design plans. Based on the subsurface observations the elevation of seasonal high groundwater water was determined to be 143.5 feet at TP-5 and 144.7 at TP-6. The proposed bottom of the designated infiltration area in the proposed conditions for the basin is set at an elevation

of 147 feet which provides more than the minimum separation from groundwater (two foot separation).
Infiltration tests were conducted in the field and also on undisturbed samples collected from the basin. These indicated that the soils underlying the basin had a hydraulic conductivity of 0.7 in/hr. Applying a factor of safety of two to this measured hydraulic conductivity results in a value of 0.35 in/hr. This rate expressed over the entire 25,500 square foot infiltration area results in an infiltration (flow) rate of 0.21 cfs. Additionally this storage provided in this portion of the basin at only a six inch depth is approximately 12,800 cubic feet. The HEC-HMS model reflects these design parameters and was run to determine the post retrofit basin performance for the New Jersey water quality storm. These calculations indicate that the basin would infiltrate the *entire* runoff volume from the 26.1 acre drainage area to the southern inlet (30 inch diameter pipe).

Dewatering time calculations were also performed to ensure that the basin would empty within the required 72 hour period to prevent mosquito breeding. Using the same factor of safety of two (0.35 in/hr), it was calculated that the basin would drain within 18 hours from a full depth of six inches in the designated infiltration area of the basin.

The basin was constructed prior to 2002. Both of the inlets have existing stable outfall protection in the form of rip rap aprons. The proposed forebay and stone filter berms are proposed to extend *farther* into the basin away from the conduit (longer than the original "La"). The stone filter berms also extend *wider* than the existing, stable outlet protection.

Operation and Maintenance

The long-term operation and maintenance requirements for this design project are minimal. The most critical and the majority of the operation and maintenance requirements will occur during the first year or two following project implementation.

During the first two years following project implementation the basin should be inspected on a monthly basis and immediately following a rainfall event of one inch or more. The flow channel should be inspected to ensure that all the seams of the erosion control blankets are intact and that no erosion features are forming. The stone filter berms should be inspected to ensure that the berms are stable and that none of the stone protection has become dislodged.

The vegetation in the basin should be inspected on a monthly basis during the first two years of operation to ensure that all the proposed plants become successfully established. Vegetative cover should be maintained at a minimum of 85% coverage. Any dead shrubs or trees should be replaced. Areas of insufficient seed germination should be reseeded according the original design plan and immediately protected with additional erosion control blankets.

During initial establishment, and continued thereafter, the project should be monitored for invasive plant species. Based on observations within the watershed this may include

Japanese knotweed (*Polygonum cuspidatum*), common reed (*Phragmites australis*), mugwort (*Artemisia vulgaris*), and multiflora rose (*Rosa multiflora*). Specifically, multiflora rose (*Rosa multiflora*) has been observed growing in close proximity to the basin. Frequent monitoring of the project for these and other potential invasive plants during the initial establishment period (1-2 years) will significantly reduce the propensity of the project to become established with these invasive and less-desirable species.

Maintenance access to both the inlet structures have been provided and shown on the plans. Maintenance access to the basin will occur through the existing access location along Michael Lane.

The basin should be inspected on a monthly basis. Long-term maintenance of the basin will primarily be limited to the periodic removal of sediment from the forebays created by the stone filter berms. This can be performed by hand or with a rubber tire mounted excavator. Accumulated sediment should be removed on an annual basis at a minimum or more frequently if inspections indicate that a more frequent sediment removal is necessary. Removed sediment should be disposed of in accordance will all applicable local, state and federal regulations.

Similar to existing conditions, periodic removal of trash and debris will also be required. The retrofit will tend to concentrate this material in the forebay areas behind the stone filter berms which will facilitate the removal of debris.

Currently the entire basin is mowed on a relatively frequent basis. Under the proposed conditions, only portions of the basin's side slopes will require periodic (monthly) mowing.

Specifications

The organization that bids and contracts this project for construction should attach their construction specifications document and any other bid documents required by their contracting staff. Each organization's requirements for specifications and bid documents will be different. Much of the specific information that must be referenced in those documents is contained on the plan sheets and can be inserted into an organization-specific set of specifications. Sample text for rip rap is included within this Sample Table of Contents to provide an example of the information that would be included within project specifications.

SAMPLE TABLE OF CONTENTS

Section 011000 – Summary

Section 012500 – Substitution Procedures

Section 013233 – Photographic Documentation

Section 015000 – Temporary Facilities and Controls

Section 015500 – Construction access and parking

Section 015626 – Temporary Fencing

Section 015639 – Temporary Tree and Plant Protection

Section 015719 – Environmental protection

Section 017113 – Mobilization & demobilization

Section 017300 – Execution

Section 017700 – Closeout procedures

Section 024119 – Selective structure demolition/removal

Section 311100 – Clearing and Grubbing

Section 311413 – Soil stripping and stockpiling

Section 312000 – Earth moving

Section 312319 – Dewatering

Section 312500 – Soil erosion and sediment control

Section 313219 – Geosynthetic soil stabilization

Section 313700 – Rip rap

1. Prior to the placement of rock riprap, filter aggregate, bedding or geotextiles, the subgrade surfaces shall be cut, filled, compacted and graded to the lines and grades as shown on the project drawings. All subgrade surfaces shall be prepared so as to be reasonably smooth, and free of mounds, dips, or windrows.
2. The placement of fill to meet design grades and elevations shall be of an approved material, and placement shall include adequate compaction of the materials.
3. No riprap, filter/ bedding aggregate or geotextile shall be placed until the subgrade is inspected and approved by the project engineer.
4. Placed as shown on the contract drawings and/or as set in these specifications.
5. Rip rap shall be placed by equipment on the surfaces and to the depths specified on the contract drawings.

6. Rip rap to be installed to the full course thickness in one operation and in such a manner as to avoid displacement of underlying subgrade or geotextile.
7. Rip rap shall be delivered in a manner that will insure homogeneous mixture of rip rap.
8. Existing rip rap shall be stockpiled and reused on site, as specified on the contract drawings. additional rip rap may be required and shall conform to the following specifications:
    a. Riprap shall be constructed of rock obtained from a source that is approved by the engineer prior to execution of a contract for the project. When possible, consideration should be given to obtaining rock that is similar in color and texture to the existing stone in the project area.
    b. Rip rap should consist of machined shot rock that is angular and clean. Rounded stones or cobbles are not to be used.
    c. Rip rap should not contain sand, dust, organic material, cracks, mineral lenses, intrusions or other impurities
    d. Filter fabric shall be placed between rip rap and ground surface.
    e. The size of the rock to be used is shown on the contract drawings

Section 329100 – Planting preparation

Section 329200 – Turf and grasses

Section 329300 – Plants

Section 334100 – Storm utility drainage piping

DESIGN PROJECT DOCUMENT FOR DRY DETENTION BASIN RETROFIT STATION #84 THOMPSON GROVE ROAD MANALAPAN TOWNSHIP

Monmouth County, New Jersey

Prepared for:

New Jersey Water Supply Authority, on behalf of the
Manalapan Brook Watershed Restoration and
Protection Plan Project Committee
Watershed Protection Programs
74 East Main Street
Somerville, New Jersey 08876-2312
(P) 908.685.0315 • (F) 908.685.0195
Email: khale@raritanbasin.org

Prepared by:

Princeton Hydro, LLC

120 East Uwchlan Avenue, Suite 204
Exton, Pennsylvania 19341
(P) 610.524.4220 • (F) 610.524.9434
Email: flubnow@princetonhydro.com

February 2011

Introduction and Project Description

The Dry Detention Basin Retrofit project is located in an existing detention basin in Manalapan Township. The purpose of this design project is to improve the water quality benefits of the basin by improving the basin's removal of Total Suspended Solids (TSS).

The existing basin has two main inlets and two main concrete low flow channels which convey flow from the inlets directly to the outlet structure. The current configuration of the basin does not provide substantial TSS removal due to the lack of vegetation over the majority of the basin, the directly connected concrete low flow channels, and the large low-flow orifice on the basin's outlet structure.

The proposed design features include the removal of a large section of the concrete low flow channels, the creation of a forebays and stone filter berms at both inlet, the elongation of the flow path, the modification of the outlet structure, and a complete re-vegetation of the basin.

The existing concrete low flow channel along the south side of the basin is not proposed to be removed. This area has become established with vegetation which primarily includes various species of sedges and rushes. The vegetation has grown over the concrete low flow channels as can be seen in the photo below which was taken during the summer of 2009. Due to the stabilized nature of this area and establishment of desirable plant species, the proposed plans do not propose any disturbance in this portion of the basin; however, proposed grading near the inlet structure on this side of the basin has been designed to divert storm flows into the larger portion of the basin for additional treatment.

Figure 1. Photo of station #84 facing west along the southern concrete low flow channel.

Under the proposed conditions flows from smaller, more frequent storm events will have access to the entire basin. The flow path during these smaller events will be substantially lengthened under proposed conditions. This will maximize the runoff contact time with vegetation, decrease flow velocity and therefore promote the removal of TSS. Furthermore, the proposed modifications to the outlet control structure will increase the detention time of the basin without compromising its peak flow attenuation performance for the larger infrequent design storm events.

The basin was evaluated to determine if the retrofit could be designed to provide infiltration of incoming stormwater runoff; however, the close proximity of the groundwater table was determined to be prohibitive to the design of an infiltration system. The proposed retrofit will provide some volume control due to the removal of portions of the concrete low flow channels and the minor regrading proposed within the basin; however, no infiltration is explicitly accounted for in the design of this retrofit. The proposed design plans also provide provisions to improve the operation and maintenance of the basin to facilitate sediment and debris removal from the basin.

In addition to the retrofits proposed within the basin, an area of exposed soil along the north side embankment is proposed to be covered with topsoil and seeded to stabilize this area and prevent the continued supply of sediment from this source.

Ancillary benefits of the project include aesthetic improvements to the basin, largely due to the proposed addition of native vegetation in the basin. The proposed condition of the basin will minimize the need for the periodic mowing of the basin. The project will also greatly increase the ecological value of the basin. The design plans also propose a location for potential educational signage. The material quantities and associated labor for the proposed design plans for station #84 were used to calculate a construction cost estimate of $47,000 for the project.

Property Access and Ownership

The basin is located within a drainage easement on Block 8400, Lot 27. The parcel is privately owned and contiguous with the residence located to the south of the basin. Therefore the property is not owned by Manalapan Township; however, Manalapan Township is responsible for maintenance and all other work within the easement as was confirmed with through discussions with the Manalapan Township Engineer. The basin is also effectively screened from the house which is located on the same lot. Potential property access for project implementation will occur along Thompson Grove Road.

Project Permitting

The implementation of this project will not require a significant amount of permitting. The following permitting guidance has been prepared to summarize the anticipated permitting requirements and thereby streamline the permitting process. This permitting information is current as of the preparation of this document but is subject to potential changes in state regulations depending on the actual implementation date of the project.

Project specific details related to all potential permitting agencies are further described in the following sections.

Flood Hazard Area Regulations

The Flood Hazard Area Control Act Rules detail the requirements for any disturbance in riparian areas. Areas regulated under these rules include the riparian zone and the flood hazard area which includes the flood fringe and floodway.

These regulated areas exist for all regulated waters as defined in N.J.A.C. 7:13-2.2. The project is located in a headwater area of an unnamed tributary of Manalapan Brook. There is a blue line stream identified by the state which crosses Thompson Grove road in close proximity (~30 feet) to the outlet structure of the basin. Based on field inspections and review of aerial photography, a defined channel does not exist until the stream is on the opposite (north) side of Thompson Grove road. Furthermore, this area has less than 50 acres of drainage area. Therefore, in accordance with N.J.A.C. 7:13-2.2, this feature is likely not a regulated water until possibly the opposite side of Thompson Grove Road.

It is recommended that an applicability determination be completed as per N.J.A.C. 7:13-5.1. This will likely confirm that the project implementation will not require flood hazard area permitting. There are no fees associated with the submittal of an applicability determination through the NJDEP.

The NJDEP surface water quality standards (N.J.A.C. 7:9) designate the nearby unnamed tributary of Manalapan Brook as a FW2-NT waterway, a freshwater stream which does not support trout production or trout maintenance. The project site is *not* located within a geologic outcrop identified by the state which contains acid producing soils. Therefore, in accordance with N.J.A.C. 7:13-4.1, the riparian zone in this area is defined as the area contained within a 50 foot buffer from the top of the bank. The channel on the north side of Thompson Grove Road is approximately 70 feet away from the basin. Therefore, a potential 50 foot riparian buffer would not encumber the proposed project. Consequently, no regulated work is proposed within a regulated area and no flood hazard area permitting or fees are likely to be required for project implementation.

Freshwater Wetlands Permitting

This project involves a retrofit of a lawfully existing stormwater management basin. The basin was originally constructed (excavated) in an uplands area. Therefore it is unlikely that the state would consider any areas contained within the basin as jurisdictional wetlands or state open waters.

The stream which begins on the opposite side of Thompson Grove Road will likely be considered state open water. Both the riparian areas of the stream and the low areas to the south east of the basin may be considered jurisdictional wetlands. Based on a review of the New Jersey Landscape Project data, it is unlikely that wetlands potentially delineated in these areas would be anything but ordinary in resource value. Ordinary resource value

wetlands and state open water do not have any transition area associated with them. Therefore it is not likely that there would be any wetland transition areas within the area of the proposed work.

It is recommended that a wetlands delineation be conducted at the site to confirm that there are no jurisdictional wetlands or transition areas within the project area. The fees associated with the Freshwater Wetlands permitting include a $600 letter of interpretation review fee plus an additional $84 per project area acre ($84 in this case). Depending on the funding source for the project implementation, these fees may potentially be waived by the NJDEP. The estimated cost for the delineation and all supporting paperwork is $2,500.

Soil Erosion and Sediment Control

The project is located within Monmouth County, therefore the Freehold Soil Conservation District will take jurisdiction for this project. Under the purview of the Soil Erosion and Sediment Control Act of 1975 (N.J.S.A. 4:24-39 and N.J.A.C. 2:90-1.1), a project that disturbs greater than 5,000 square feet of land area must apply to the county soil conservation district for a soil erosion and sediment control plan approval. The total disturbance area for this project is 43,497 square feet.

Since this project exceeds the 5,000 square foot threshold, the project will require a soil erosion and sediment control plan certification. A fee of $975 is expected in accordance with the Freehold Soil Conservation District fee schedule. Three copies of the plan set must be submitted along with the application fee.

Hydrologic Calculations

The detention basin collects stormwater runoff from the adjacent neighborhood which includes the majority of the Regency Way loop road. The basin also collects runoff from a portion of Thompson Grove road. Inflow is split between two separate inflow structures. The soils in the vicinity of the detention basin are primarily defined by a hydrologic soil group classification of ‘B’.

A hydrologic model was created to calculate the peak flow rates and corresponding peak water surface elevations in the basin. The roughly 40 acre drainage area to the basin was split into sub areas to account for the two separate inlets to the basin. The Army Corps of Engineers HEC-HMS model was used for all hydraulic and hydrologic calculations. Time of concentration calculations were performed using the TR-55 methodology. Flows were routed through the basin using the Modified Puls methodology with geometry and outflow structure configurations based on the surveyed and proposed information.

The model indicated that the peak flow rate resulting from the 25-year design storm for Monmouth County (6.5 inches in 24 hours, Type III distribution) resulted in a peak inflow rate of 58 cubic feet per second (cfs) at the 24 inch diameter southern inlet and 4.6 cfs at the 15 inch inlet along Thompson Grove Road.

Calculations were conducted in accordance with the Standards for Soil Erosion and Sediment Control in New Jersey, Section 12. Routing of the two-year design storm for Monmouth County (3.6 inches in 24 hours, Type III distribution) resulted in a peak elevation in the basin of 153.4 feet, based on the invert elevations of the two pipes, no tailwater conditions could be considered when verifying the design of the stone filter berms. The calculation for the outfall protection indicated that a standard rip rap apron would need to have a length "La" of 18 feet for the southern inlet and 15 feet for the inlet along Thompson Grove Road.

The centerline of the proposed stone filter berm is 15 feet from the outfall to facilitate maintenance by standard equipment. The stone extends to a maximum length of 20 feet from the outfall. This length exceeds the length requirement for a potential apron for both inlets. It is further noted that both inlet locations at the basin appear to be relatively stable with the current protection which will remain in place under the proposed conditions.

Manning's equation was used to calculate the capacity of the proposed channel (flow path) in the basin. Based on a slope of 0.0071 (ft/ft) and a Manning's 'n' of 0.035 the channel has the capacity to convey 42 cfs at a velocity of 3.0 feet per second (fps). It should be noted that the capacity of the low flow orifice does not approach this capacity, therefore flow rates on the order of 42 cfs, by design, will quickly back up and create much slower velocities within the basin. This facilitates the removal of TSS in the basin.

This design project includes a slight modification of the basin's outlet structure. The purpose of this modification is to increase the detention time in the basin and thereby improve its TSS removal capability. The pre versus post retrofit conditions of the basins were both compared using the HEC-HMS software. The purpose of this comparison was to quantify the improved function of the basin and ensure that the basin's original offsite stability function is not significantly impaired by the retrofit.

In order to quantify the hydraulic performance improvement of the outlet structure retrofit, the New Jersey water quality storm (1.25 inches over a two-hour period) was simulated for pre and post retrofit conditions. A comparison of the basin storage during this design storm event is provided below.

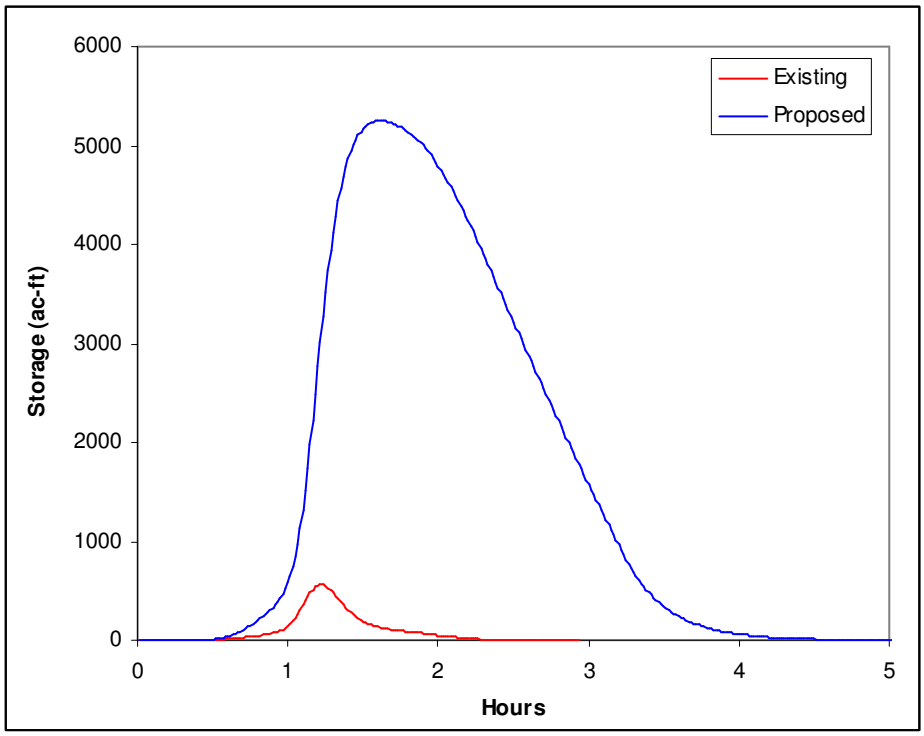


Figure 2. Storage versus time for the NJ water quality storm at station #84.

The plot illustrates the additional storage provided during the storm event. Under existing conditions, the basin would only have ponded water for approximately two hours, while under proposed conditions, the basin would maintain storage for approximately four hours. Furthermore, the existing basin is only predicted to have 269 cubic feet-hours of total storage time (area under the curve), while the proposed basin would have 8,000 cubic-feet-hours of storage time. The modification does not extend the duration of ponded conditions to levels that would even approach the requirements for mosquito breeding (~72 hours).

The two, ten and one-hundred year storms were also analyzed under pre and post retrofit conditions; however, it is not difficult to determine what the original preconstruction flow rates were (flow rates prior to the development of the drainage area). For more detail the original design documentation would need to be reviewed. This documentation was not made available at the time of this analysis. For the two-year storm, the retrofit basin would *reduce* the peak outflow from the basin from 11 cfs to 7.9 cfs. For the 10-year storm, the retrofit would result in a slight increase from 31 to 33 cfs and for the 100-year storm event, the peak outflows are the same at 103 cfs.

Operation and Maintenance

The long-term operation and maintenance requirements for this design project are minimal. The most critical and the majority of the operation and maintenance requirements will occur during the first year or two following project implementation.

During the first two years following project implementation, the basin should be inspected on a monthly basis and immediately following a rainfall event of one inch or more. The flow channel should be inspected to ensure that all the seams of the erosion control blankets are intact and that no erosion features are forming. The stone filter berms should be inspected to ensure that the berms are stable and that none of the stone protection has become dislodged.

The vegetation in the basin should be inspected on a monthly basis during the first two years of operation to ensure that all the proposed plants become successfully established. Vegetative cover should be maintained at a minimum of 85% coverage. Any dead shrubs or trees should be replaced. Areas of insufficient seed germination should be reseeded according the original design plan and immediately protected with additional erosion control blankets.

During initial establishment, and continued thereafter, the project should be monitored for invasive plant species. Based on observations within the watershed this may include Japanese knotweed (*Polygonum cuspidatum*), common reed (*Phragmites australis*), mugwort (*Artemisia vulgaris*), and multiflora rose (*Rosa multiflora*). Frequent monitoring of the project for these and other potential invasive plants during the initial establishment period (1-2 years) will significantly reduce the propensity of the project to become established with these invasive and less-desirable species. The broadleaf cattail (*Typha latifolia*) is a native species and has been previously observed in the basin. This plant is not included in the planting plan; however, it is a native species and is rarely considered a weed. The plant will likely only tend to inhabit the lower sections of the basin and will not interfere with the design intention of the basin retrofit.

Maintenance access to both the inlet structures have been provided and shown on the plans. Maintenance access to the basin will occur along the Thompson Grove Road as the remainder of the basin's perimeter is encumbered by residential properties.

The basin should be inspected on a monthly basis. Long-term maintenance of the basin will primarily be limited to the periodic removal of sediment from the forebays created by the stone filter berms. This can be performed by hand or with a rubber tire mounted excavator. Accumulated sediment should be removed on an annual basis at a minimum or more frequently if inspections indicate that a more frequent sediment removal is necessary. Removed sediment should be disposed of in accordance will all applicable local, state and federal regulations.

Similar to existing conditions, periodic removal of trash and debris will also be required. The retrofit will tend to concentrate this material in the forebay areas behind the stone filter berms which will facilitate the removal of debris.

Currently, the entire basin is mowed on a relatively frequent basis. Under the proposed conditions, only portions of the basin's side slopes will require periodic (monthly) mowing.

Specifications

The organization that bids and contracts this project for construction should attach their construction specifications document and any other bid documents required by their contracting staff. Each organization's requirements for specifications and bid documents will be different. Much of the specific information that must be referenced in those documents is contained on the plan sheets and can be inserted into an organization-specific set of specifications. A sample table of contents which outlines many of the basic specifications that will likely be required for this for this project is included below. Sample text for rip rap is included within this Sample Table of Contents to provide an example of the information that would be included within project specifications.

SAMPLE TABLE OF CONTENTS

Section 011000 – Summary

Section 012500 – Substitution Procedures

Section 013233 – Photographic Documentation

Section 015000 – Temporary Facilities and Controls

Section 015500 – Construction access and parking

Section 015626 – Temporary Fencing

Section 015639 – Temporary Tree and Plant Protection

Section 015719 – Environmental protection

Section 017113 – Mobilization & demobilization

Section 017300 – Execution

Section 017700 – Closeout procedures

Section 024119 – Selective structure demolition/removal

Section 055000 – Metal Fabrications

Section 311413 – Soil stripping and stockpiling

Section 312000 – Earth moving

Section 312319 – Dewatering

Section 312500 – Soil erosion and sediment control

Section 313219 – Geosynthetic soil stabilization

Section 313700 – Rip rap

1. Prior to the placement of rock riprap, filter aggregate, bedding or geotextiles, the subgrade surfaces shall be cut, filled, compacted and graded to the lines and grades as shown on the project drawings. All subgrade surfaces shall be prepared so as to be reasonably smooth, and free of mounds, dips, or windrows.
2. The placement of fill to meet design grades and elevations shall be of an approved material, and placement shall include adequate compaction of the materials.
3. No riprap, filter/ bedding aggregate or geotextile shall be placed until the subgrade is inspected and approved by the project engineer.
4. Placed as shown on the contract drawings and/or as set in these specifications.
5. Rip rap shall be placed by equipment on the surfaces and to the depths specified on the contract drawings.
6. Rip rap to be installed to the full course thickness in one operation and in such a manner as to avoid displacement of underlying subgrade or geotextile.
7. Rip rap shall be delivered in a manner that will insure homogeneous mixture of rip rap.
8. Existing rip rap shall be stockpiled and reused on site, as specified on the contract drawings. additional rip rap may be required and shall conform to the following specifications:

    a. Riprap shall be constructed of rock obtained from a source that is approved by the engineer prior to execution of a contract for the project. When possible, consideration should be given to obtaining rock that is similar in color and texture to the existing stone in the project area.
    b. Rip rap should consist of machined shot rock that is angular and clean. Rounded stones or cobbles are not to be used.
    c. Rip rap should not contain sand, dust, organic material, cracks, mineral lenses, intrusions or other impurities
    d. Filter fabric shall be placed between rip rap and ground surface.
    e. The size of the rock to be used is shown on the contract drawings

Section 329100 – Planting preparation

Section 329200 – Turf and grasses

Section 329300 – Plants

Section 334100 – Storm utility drainage piping

WETLAND WATER QUALITY BASIN RETROFIT

AT STATION #32
OAKWOOD TRAIL/NEW STREET
BLOCK 68.02, LOT 19
MONROE TOWNSHIP
MIDDLESEX COUNTY, NEW JERSEY

GENERAL NOTES:

1. ALL ELEVATIONS AND QUANTITIES ARE BASED ON IN-SITU CONDITIONS. ONCE DISTURBED, MATERIAL CONDITIONS CAN VARY SIGNIFICANTLY.
2. THE APPROVAL AND USE OF THESE PLANS ARE FOR THE PROJECT OWNER AS DEPICTED ON THIS SHEET. THIS PLAN IS NOT TO BE UTILIZED IN THE PREPARATION OF ANY OTHER PROJECTS.
3. AS FIELD CONDITIONS MAY REQUIRE MODIFICATIONS TO PROPOSED TOPOGRAPHIC ELEVATIONS AND FACILITY LOCATIONS, THESE PLANS ARE NOT TO BE UTILIZED FOR AS-BUILTS OR FOR PURPOSES OTHER THAN STATED HEREIN.
4. THESE PLANS ARE NOT TO BE UTILIZED FOR CONSTRUCTION, UNTIL ALL REQUIRED LOCAL, STATE, AND FEDERAL PERMITS ARE OBTAINED.

CONSTRUCTION NOTES:

1. SOIL, ROCK, OR OTHER MATERIALS TO BE UTILIZED FOR FILLING OR BACKFILLING SHALL BE APPROVED BY A QUALIFIED GEOTECHNICAL ENGINEER.
2. ALL MATERIALS SHALL CONFORM TO THE LATEST AMERICAN STANDARDS FOR TESTING AND MATERIALS SPECIFICATIONS (ASTM).
3. PROXIMITY OF STOCKPILES TO THE EDGE OF EXCAVATIONS SHALL BE SUCH THAT THE INFLUENCE OF THE STOCKPILE SURCHARGE ON THE MODIFIED OR EXISTING SLOPE IS REDUCED. WHERE POSSIBLE STOCKPILES WILL BE PLACED A DISTANCE FROM THE EDGE OF EXCAVATION EQUAL TO (OR GREATER THAN) THE HEIGHT OF THE EXCAVATION.
4. ALL STOCKPILED MATERIAL PROPOSED FOR USE WILL BE PROTECTED FROM EXCESSIVE LOSS OR GAIN OF MOISTURE USING SECURELY ANCHORED PLASTIC COVERS OR EQUIVALENT METHODS.
5. UTILITIES SHALL BE LOCATED BY THE CONTRACTOR PRIOR TO CONSTRUCTION.
6. NECESSARY PRECAUTIONS SHALL BE TAKEN BY THE CONTRACTOR TO PROTECT EXISTING SERVICES AND MAINS. ANY DAMAGE TO EXISTING SERVICES OR MAINS SHALL BE REPAIRED IMMEDIATELY AT THE CONTRACTOR'S EXPENSE.
7. EXCAVATIONS AND STOCKPILES IN NO WAY SHALL HAVE SLOPES STEEPER THAN 2:1.
8. THE CONTRACTOR SHALL NOTE THAT IN THE CASE OF A DISCREPANCY BETWEEN THE SCALED AND THE FIGURED DIMENSIONS SHOWN ON THESE PLANS, THE FIGURED DIMENSIONS SHALL APPLY.
9. IT SHALL BE DISTINCTLY UNDERSTOOD THAT FAILURE TO MENTION SPECIFICALLY ANY WORK THAT WOULD NORMALLY BE REQUIRED TO COMPLETE THE PROJECT, SHALL NOT RELIEVE THE CONTRACTOR OF RESPONSIBILITY TO PERFORM THE WORK.
10. IT SHALL BE THE CONTRACTORS RESPONSIBILITY TO ASSURE THE ACCURACY OF THE PROPERTY BOUNDARIES.
11. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE REPAIR AND REPLACEMENT OF PROPERTY DAMAGE TO FENCES, SIGNS, STRUCTURES, VEGETATION, IRRIGATION, LANDSCAPING COMPONENTS, AND ANY OTHER PROPERTY ITEMS THAT ARE REMOVED FOR THE PURPOSES OF THE PROJECT LOGISTICS AND ACCIDENTS.
12. EXISTING ASPHALT SURFACES SHALL REMAIN UNDISTURBED EXCEPT FOR THE PROPOSED WORK AS CALLED FOR ON THESE PLANS. ANY DAMAGE TO THESE ASPHALT SURFACES SHALL BE THE SOLE RESPONSIBILITY OF THE CONTRACTOR AND ALL COSTS FOR REPAIRS SHALL BE BORNE BY THE CONTRACTOR.
13. THE CONTRACTOR SHALL PROVIDE NECESSARY MAINTENANCE AND PROTECTION OF TRAFFIC MEASURES. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO PROVIDE TRAFFIC CONTROL FOR THE ADJACENT PARKING LOT AREA.
14. THIS PROJECT IS LOCATED WITHIN THE MAGOTHY GEOLOGIC FORMATION WHICH IS LIKELY TO CONTAIN ACID PRODUCING SOILS.

CONSTRUCTION SAFETY AND SECURITY:

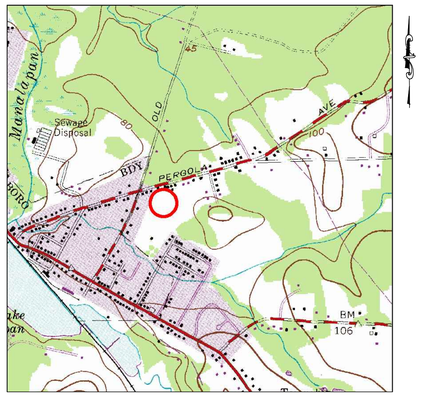
1. ALL CONSTRUCTION SHALL ADHERE TO OSHA STANDARDS AND REGULATIONS.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PURCHASE AND INSTALLATION OF HIGH VISIBILITY FENCING TO BE PLACED ALONG THE PROJECT PERIMETER. WARNING SIGNS SHALL ALSO BE PROVIDED.
3. THE CONTRACTOR SHALL PROVIDE CONSTRUCTION WARNING SIGNS AND TRAFFIC CONTROL AS REQUIRED BY THE NJ DEPARTMENT OF TRANSPORTATION WITH REGARD TO ACCESS OF CONSTRUCTION VEHICLES AND TRUCKS UTILIZING MUNICIPAL OF STATE ROADWAYS.

PREPARED FOR:

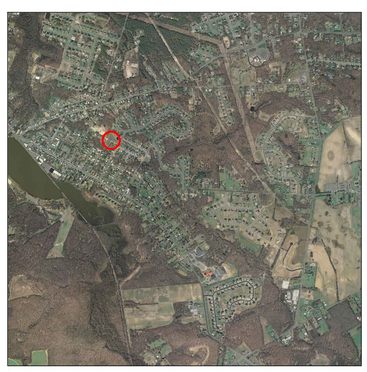
NEW JERSEY WATER SUPPLY AUTHORITY
ON BEHALF OF
THE MANALAPAN BROOK WATERSHED RESTORATION AND PROTECTION PLAN PROJECT COMMITTEE
WATERSHED PROTECTION PROGRAMS
74 EAST MAIN STREET
SOMERVILLE, NJ 08876-2312
P. 908.685.0315

SHEET INDEX:

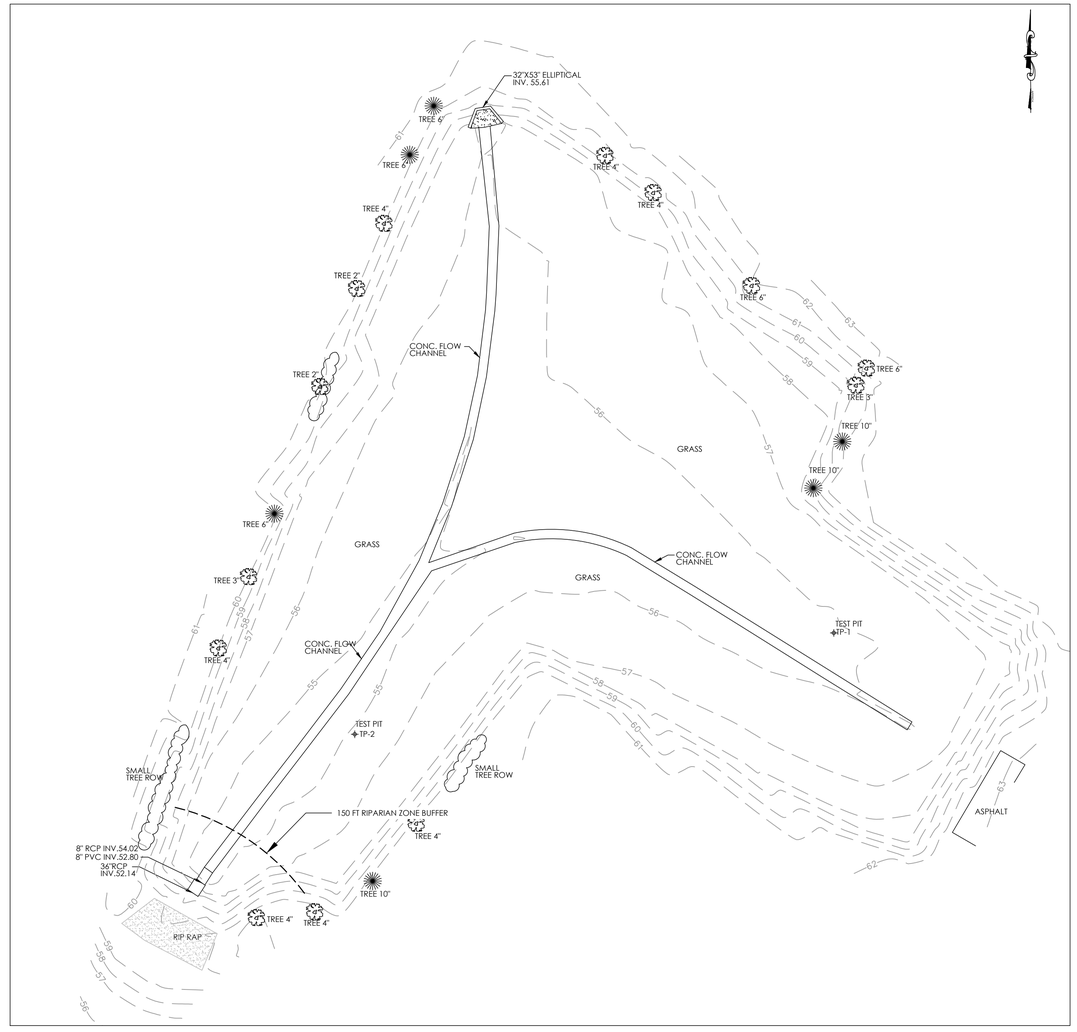
SHEET 1 - TITLE SHEET
SHEET 2 - PROPOSED CONDITIONS AND DETAILS
EROSION & SEDIMENT CONTROL PLAN AND DETAILS
SHEET 3 - PLANTING PLAN
SHEET 4 - EROSION AND SEDIMENT CONTROL NOTES



A PROJECT VICINITY
SCALE: 1" = 2000'
USGS QUADRANGLE
7.5 MINUTE SERIES
JAMESBURG, NEW JERSEY QUADRANGLE



B ORTHOPHOTOGRAPHY
SITE LOCATION
1"=2000'



GRAPHIC SCALE
0 10 20 30 60 90 120 FEET
SCALE: 1" = 30'

C EXISTING CONDITIONS

CALL BEFORE YOU DIG!
NEW JERSEY LAW REQUIRES
3 WORKING DAYS NOTICE FOR
CONSTRUCTION PHASE AND 10 WORKING
DAYS IN DESIGN STAGE -- STOP CALL
NEW JERSEY ONE CALL SYSTEM, INC.
REFERENCE NEW JERSEY TITLE 48, CHPT. 2, ARTICLE 9
1-800-272-1000

PROJECT NOTES

GENERAL NOTES:

1. EXISTING CONDITIONS OBTAINED FROM SURVEY COMPLETED BY J. TIMOTHY KERNAN, INC. FROM NOVEMBER 17, 2010 THRU DECEMBER 23, 2010.
2. THE HORIZONTAL DATUM IS NORTH AMERICAN DATUM 1983 (NAD83) NEW JERSEY STATE PLANE (FIPS 2900). UNITS OF FEET.
3. THE VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM 1988 (NGVD88). UNITS OF FEET.
4. NO WETLANDS DELINEATION WAS COMPLETED AS PART OF THIS TOPOGRAPHIC SURVEY. PLEASE SEE PERMITTING GUIDANCE DOCUMENT.

DATE	DESCRIPTION

REVISIONS

STATE OF NEW JERSEY CERTIFICATE OF AUTH.
NO.: 24GA27976800

KEITHE J. MERL
Professional Engineer
NJ Lic. No. GE44839

DATE

PRINCETON HYDRO, LLC
SCIENTISTS AND ENGINEERS
120 EAST UWCHLAN AVENUE
SUITE 204
EXTON, PENNSYLVANIA 19341
PHONE. 610.524.4220
FAX. 610.514.9434
WWW.PRINCETONHYDRO.COM

PROJECT NAME/LOCATION:
WETLAND WATER QUALITY BASIN RETROFIT
AT STATION #32
MONROE TOWNSHIP
MIDDLESEX COUNTY, NEW JERSEY

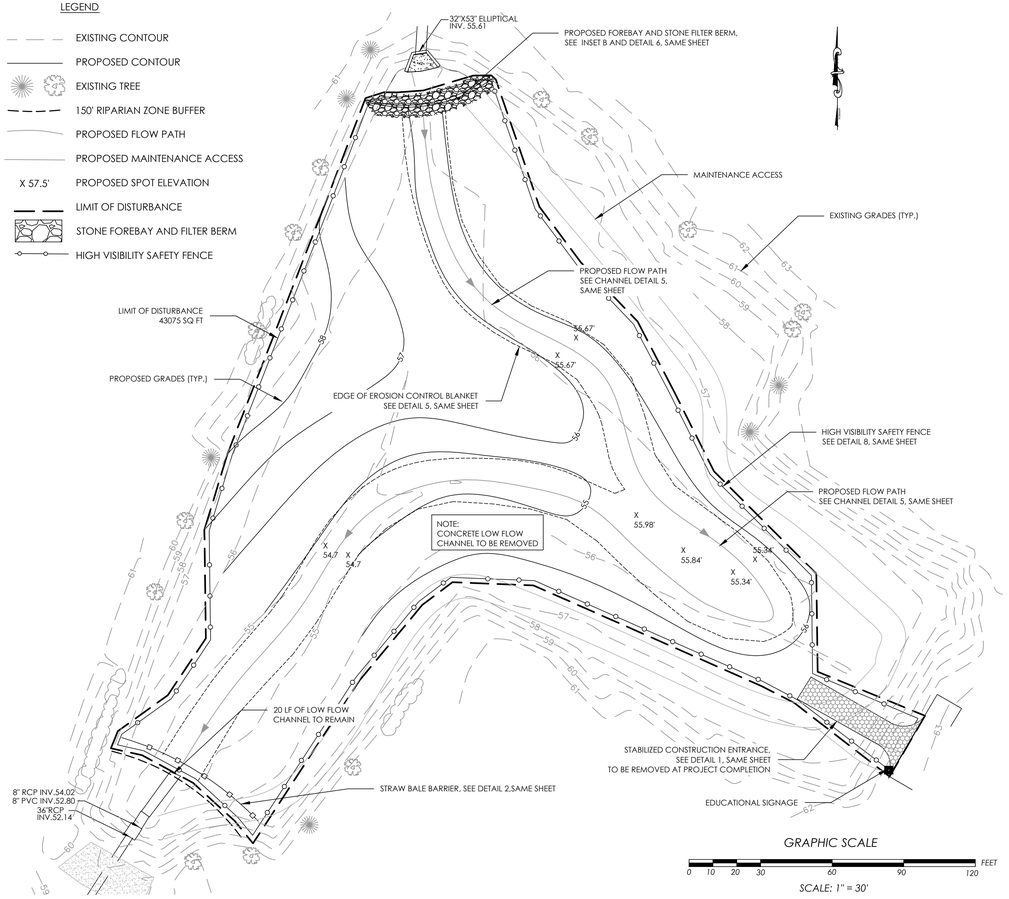
DRAWING NAME:
TITLE SHEET
WITH EXISTING CONDITIONS

DATE:	02/28/2011
PROJECT NO.:	0457.008
SCALE:	AS SHOWN
DRAWN BY:	JEO
CHECKED BY:	KJM

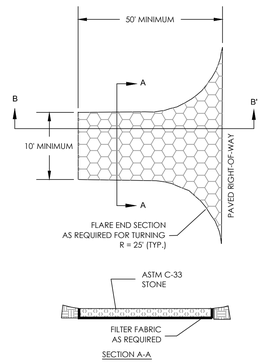
SHEET NO.
1 OF 4

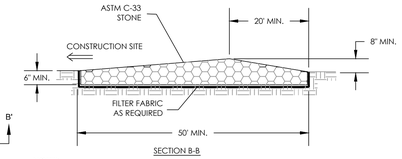
LEGEND

- EXISTING CONTOUR
- PROPOSED CONTOUR
- EXISTING TREE
- 150' RIPARIAN ZONE BUFFER
- PROPOSED FLOW PATH
- PROPOSED MAINTENANCE ACCESS
- X 57.5' PROPOSED SPOT ELEVATION
- LIMIT OF DISTURBANCE
- STONE FOREBAY AND FILTER BERM
- HIGH VISIBILITY SAFETY FENCE



A PROPOSED CONDITIONS

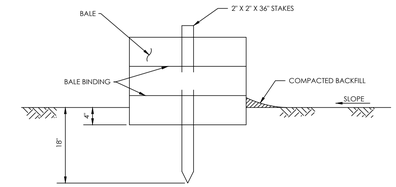




NOTES:

1. STABILIZED CONSTRUCTION ENTRANCE WILL BE CONSTRUCTED AS SHOWN ON THE DETAIL.
2. STONE SIZE - ASTM C-33, SIZE NO. 2 OR 3. THE STONE SHALL CONSIST OF CLEAN CRUSHED ANGULAR PARTICLES. RECYCLED CONCRETE OF SIMILAR SIZE MAY BE SUBSTITUTED BUT WILL REQUIRE MORE FREQUENT REPLENISHMENT AND MAINTENANCE.
3. GEOTEXTILE FABRIC SHALL BE USED UNDER THE STONE.
4. THE STRUCTURE'S THICKNESS WILL BE CONSTANTLY MAINTAINED AT THE SPECIFIED DIMENSIONS BY ADDING MATERIAL (SEE NOTE 2) WHEN NECESSARY.
5. ALL SEDIMENT SPILLED, DROPPED, WASHED, OR TRACKED ONTO PUBLIC RIGHTS-OF-WAY MUST BE REMOVED IMMEDIATELY.
6. SITE LIMITATIONS PREVENT INSTALLATION OF THE STABILIZATION CONSTRUCTION ENTRANCE AS PER THE STANDARD (I.E. 100 FEET).

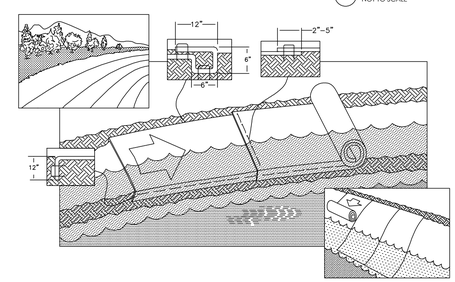
1 STABILIZED CONSTRUCTION ENTRANCE
NOT TO SCALE



NOTES:

1. STRAW BALE BARRIERS SHOULD NOT BE USED FOR MORE THAN 3 MONTHS.
2. EMBED BALES 4 INCHES AND ANGLE FIRST STAKE TOWARD PREVIOUSLY LAID BALE.
3. STRAW BALE BARRIERS SHALL BE PLACED AT EXISTING LEVEL GRADE. BOTH ENDS OF THE BARRIER SHALL BE EXTENDED SUFFICIENTLY UP THE SLOPE SUCH THAT THE BASE OF THE END BALES IS A MINIMUM OF 18 INCHES ABOVE THE TOP OF THE LOWEST BALE.
4. SEDIMENT SHALL BE REMOVED WHEN ACCUMULATIONS REACH 1/3 THE ABOVE GROUND HEIGHT OF THE BARRIER.
5. ANY SECTION OF STRAW BALE BARRIER WHICH HAS BEEN UNDERMINED OR TOPPED SHALL BE IMMEDIATELY REPLACED WITH A ROCK FILTER OUTLET.

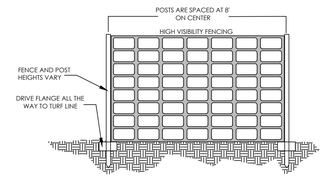
2 STRAW BALE BARRIER
NOT TO SCALE



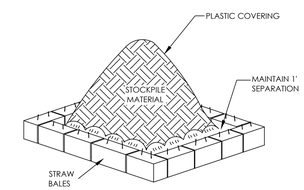
NOTES:

1. EROSION CONTROL BLANKET SHALL BE COIR MAT 900 OR APPROVED EQUIVALENT
2. STAPLES OR STAKES SHALL BE 6" MINIMUM HEIGHT UNLESS OTHERWISE REQUIRED.
3. PREPARE SOIL (AS PER SEEDING SPECIFICATIONS, SHEET 4 OF 4) BEFORE INSTALLING EROSION CONTROL BLANKETS (ECB'S) INCLUDING ANY NECESSARY APPLICATION OF LIME, FERTILIZER, STRAW AND SEED.
4. BEGIN AT THE TOP OF THE AREA BY ANCHORING THE BLANKET IN A 6" DEEP BY 6" WIDE TRENCH WITH A MINIMUM 12" OF EXTENDED BEYOND THE UP-SLOPE PORTION OF THE TRENCH. ANCHOR THE BLANKET WITH A ROW OF STAPLES/STAKES A MINIMUM 12" APART IN THE BOTTOM OF THE TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING. APPLY SEED TO COMPACTED SOIL AND FOLD REMAINING 12" PORTION OF ECB BACK OVER SEED AND COMPACTED SOIL. SECURE OVER COMPACTED SOIL WITH A ROW OF STAPLES/STAKES SPACED APPROXIMATELY 12" APART ACROSS THE WIDTH OF THE BLANKET.
5. ROLL ECB'S DOWN CHANNEL. ECB'S WILL UNROLL WITH APPROPRIATE SIDE AGAINST THE SOIL SURFACE. ALL ECB'S MUST BE SECURELY FASTENED TO SOIL SURFACE BY PLACING STAPLES/STAKES IN APPROPRIATE LOCATIONS AS SHOWN IN THE STAPLE PATTERN GUIDE.
6. THE EDGES OF ALL HORIZONTAL AND VERTICAL SEAMS MUST BE STAPLED WITH APPROXIMATELY 2"-5" OVERLAP, SEAM OVERLAP SHOULD BE SHINGLED ACCORDING TO PREDOMINANT EROSIVE ACTION.
7. IN LOOSE SOIL CONDITIONS, THE USE OF STAPLE OR STAKE LENGTHS GREATER THAN 6" MAY BE NECESSARY TO PROPERLY ANCHOR THE ECB'S

3 EROSION CONTROL BLANKET
NOT TO SCALE



8 HIGH VISIBILITY SAFETY FENCE
NOT TO SCALE



NOTE:

1. UPON PRIOR APPROVAL FROM ENGINEER: SILT FENCING MAY BE SUBSTITUTED FOR STRAW BALES, AND TEMPORARY SEEDING OF STOCKPILES MAY BE SUBSTITUTED FOR PLASTIC COVERING.

4 STOCKPILE CONTROL
NOT TO SCALE

CONSTRUCTION SEQUENCE

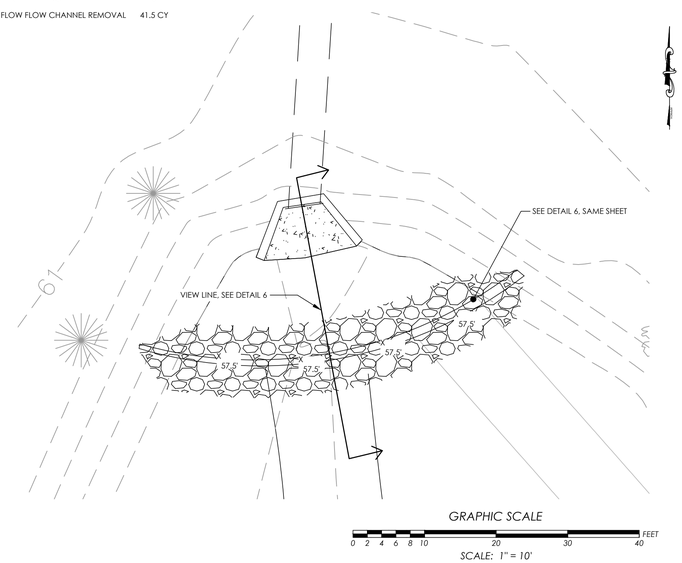
1.	INSTALL EROSION AND SEDIMENT CONTROL MEASURES	1 DAY
2.	REMOVE CONCRETE LOW FLOW CHANNEL	2 DAYS
3.	GRADE AS SHOWN	4 DAYS
4.	INSTALL SEDIMENT FOREBAY AND STONE FILTER BERM	1 DAY
5.	SEED	2 DAYS
6.	INSTALL EROSION CONTROL BLANKET	2 DAYS
7.	PLANT PLUGS	1 DAY
8.	REMOVE EROSION AND SEDIMENT CONTROL MEASURES AND STABILIZED CONSTRUCTION ENTRANCE AFTER BASIN IS COMPLETELY STABILIZED	1 DAY
		TOTAL: 14 DAYS

CONSTRUCTION NOTES:

1. FINISHED GRADE SHALL INCLUDE A MINIMUM OF 4 INCHES OF VIABLE TOPSOIL FOR PLANTING PURPOSES, CONSISTENT WITH EXISTING CONDITIONS.
2. THE FOLLOWING SEQUENCE OF CONSTRUCTION IS RECOMMENDED:
   - SEGREGATE TOPSOIL FROM AREAS TO BE GRADED
   - GRADE TO 4 INCHES BELOW PROPOSED GRADE ELEVATIONS (AS SHOWN DETAIL A, SAME SHEET)
   - REPLACE 4" OF TOPSOIL TO ACHIEVE FINAL GRADE
3. NO RUBBER TIRE MACHINES TO BE USED, LOW GROUND PRESSURE TRACK MACHINE TO BE USED.

QUANTITIES

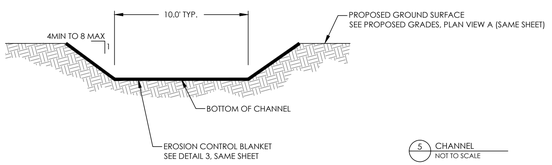
STRAW BALE BARRIER	73 LF
STONE FOR CONSTRUCTON ENTRANCE	11 CY
STONE FOR FOREBAY AND STONE FILTER BERM	38 CY
EROSION CONTROL BLANKET	1200 SY
HIGH VISIBILITY SAFETY FENCE	1126 LF
CONCRETE FLOW FLOW CHANNEL REMOVAL	41.5 CY



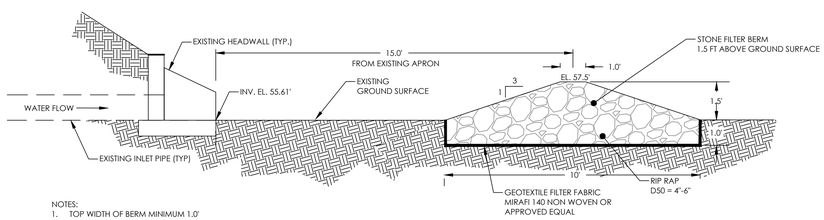
B PROPOSED FOREBAY AND STONE FILTER BERM INSET

NOTES:

1. CHANNEL SIDE SLOPES SHALL BE CONSTRUCTED NO STEEPER THAN 4H:1V
2. THE TOP WIDTH OF THE CHANNEL WILL VARY BASED ON THE BUILDABLE CHANNEL SIDE SLOPE ANGLE. MINIMUM TOP WIDTH OF THE CHANNEL IS 18'.
3. DEPTH OF CHANNEL IS MINIMUM 0.5 FT AND MAXIMUM 1.0 FT BASED ON PROPOSED GRADES



5 CHANNEL
NOT TO SCALE



NOTES:

1. TOP WIDTH OF BERM MINIMUM 1.0'
2. MAINTAIN SIDE SLOPES NO STEEPER THAN 3:1 (H:V)
3. STONE FILTER BASE TO BE INSTALLED 1 FOOT BELOW PROPOSED FINAL GRADES

6 FOREBAY AND STONE FILTER BERM
NOT TO SCALE

CALL BEFORE YOU DIG!
NEW JERSEY LAW REQUIRES
3 WORKING DAYS NOTICE FOR CONSTRUCTION PHASE AND 10 WORKING DAYS IN DESIGN STAGE – STOP CALL
NEW JERSEY ONE CALL SYSTEM, INC.
REFERENCE NEW JERSEY TITLE 48, CHPT. 2, ARTICLE 9
1-800-272-1000

PROJECT NOTES

GENERAL NOTES:

1. EXISTING CONDITIONS OBTAINED FROM SURVEY COMPLETED BY J. TIMOTHY KERNAN, INC. FROM NOVEMBER 17, 2010 THRU DECEMBER 23, 2010.
2. THE HORIZONTAL DATUM IS NORTH AMERICAN DATUM 1983 (NAD83) NEW JERSEY STATE PLANE (FIPS 2900), UNITS OF FEET.
3. THE VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM 1988 (NGVD88), UNITS OF FEET.
4. NO WETLANDS DELINEATION WAS COMPLETED AS PART OF THIS TOPOGRAPHIC SURVEY. PLEASE SEE PERMITTING GUIDANCE DOCUMENT.

DATE	DESCRIPTION

REVISIONS

STATE OF NEW JERSEY CERTIFICATE OF AUTH. NO.: 24GA27976800

KEITHE J. MERL
Professional Engineer
NJ Lic. No. GE44839

DATE

PRINCETON HYDRO, LLC
SCIENTISTS AND ENGINEERS
120 EAST UWCHLAN AVENUE
SUITE 204
EXTON, PENNSYLVANIA 19341
PHONE. 610.524.4220
FAX. 610.524.9434
WWW.PRINCETONHYDRO.COM

PROJECT NAME/LOCATION:
WETLAND WATER QUALITY BASIN RETROFIT
AT STATION #32
MONROE TOWNSHIP
MIDDLESEX COUNTY, NEW JERSEY

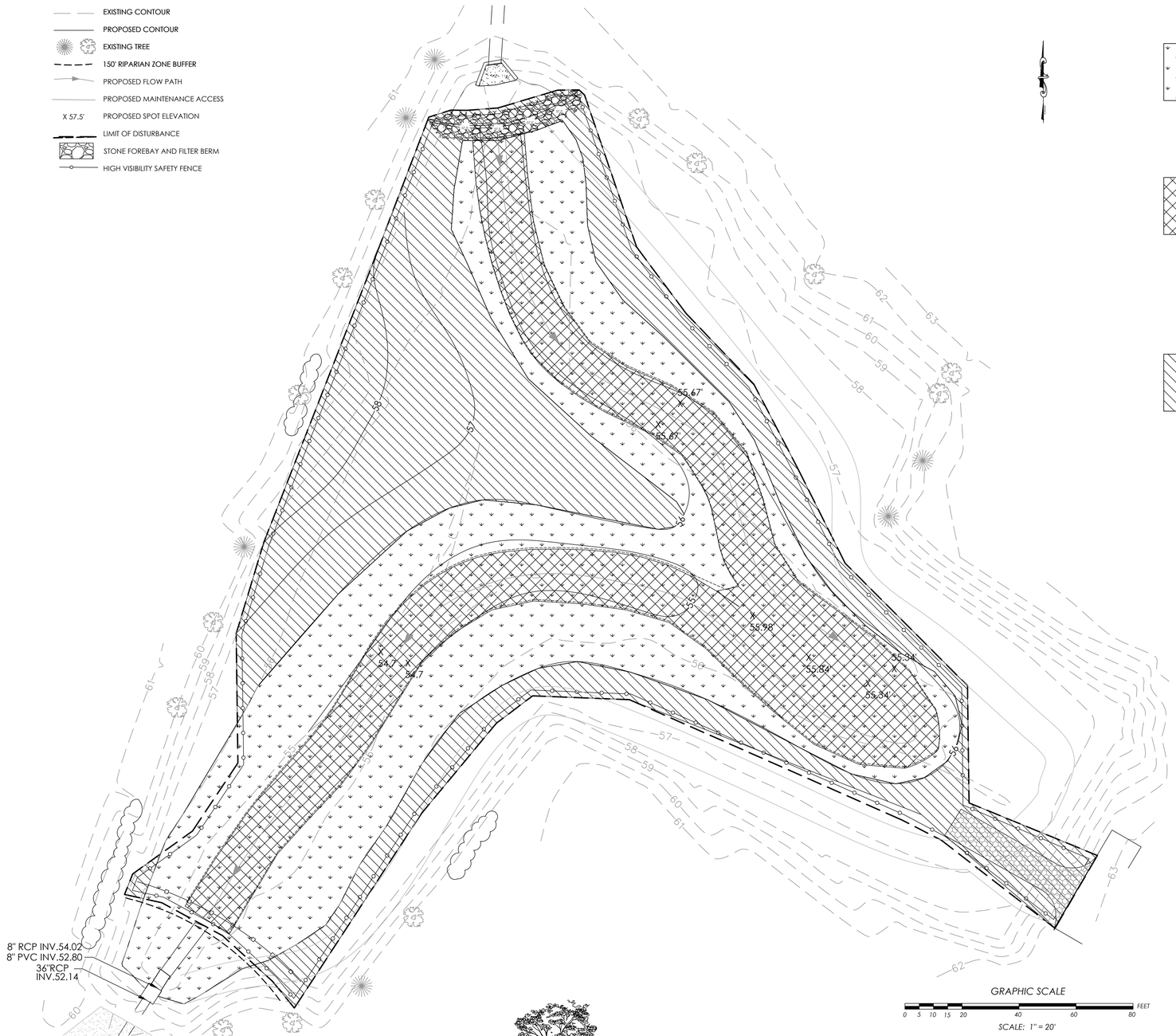
DRAWING NAME:
PROPOSED CONDITIONS AND EROSION & SEDIMENT CONTROL PLAN AND DETAILS

DATE:	02/28/2011
PROJECT NO.:	0457.008
SCALE:	AS SHOWN
DRAWN BY:	JEO
CHECKED BY:	KJM

SHEET NO.
2 OF 4

LEGEND

- EXISTING CONTOUR
- PROPOSED CONTOUR
- EXISTING TREE
- 150' RIPARIAN ZONE BUFFER
- PROPOSED FLOW PATH
- PROPOSED MAINTENANCE ACCESS
- X 57.5' PROPOSED SPOT ELEVATION
- LIMIT OF DISTURBANCE
- STONE FOREBAY AND FILTER BERM
- HIGH VISIBILITY SAFETY FENCE



GRAPHIC SCALE

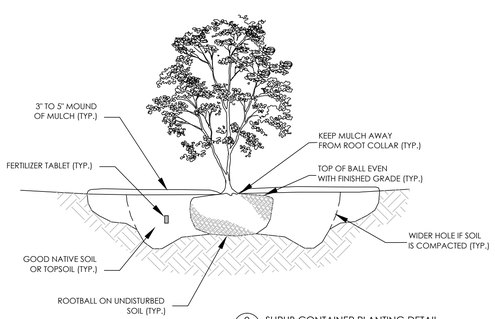
0 5 10 15 20 40 60 80 FEET

SCALE: 1" = 20'

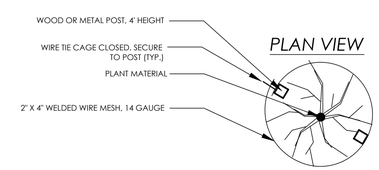
A PLANTING PLAN

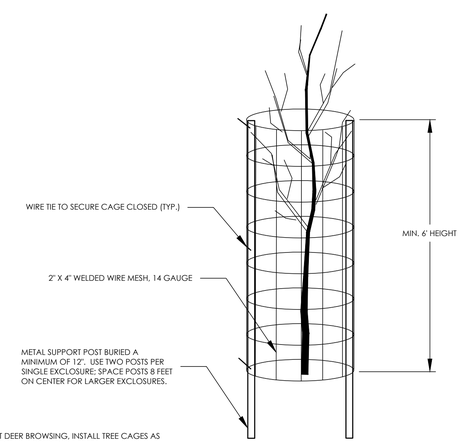
PLANT LIST AND KEY

WET MEADOW SEED		26,630 SQUARE FEET		
BOTANICAL NAME	SPECIES NAME	APPROXIMATE RATE (LBS PER LIVE SEED/ACRE)	INDICATOR STATUS:	
ELYMUS RIPARIUS	RIVERBANK WILD RYE	1/2	FACW	
HELENIUM AUTUMNALE	HELEN'S FLOWER	2	FACW+	
JUNCUS EFFUSUS	SOFT RUSH	1	FACW+	
PANICUM DICHOTOMIFLORUM	SMOOTH PANIC GRASS	5	FACW-	
PANICUM VIRGATUM	SWITCH GRASS	3	FAC	
POLYGONUM PENSYLVANICUM	PENNSYLVANIA SMARTWEED	2	FACW	
SCIRPUS ATROVIRENS	GREEN BULRUSH	2	OBL	
VERBENA HASTATA	BLUE VERVAIN	2	FACW+	
WET MEADOW PLUGS		11,190 SQUARE FEET		
PLANTED IN GROUPS OF FIVE PLUGS PLUGS OF SAME SPECIES. TO BE SPACED THREE (3) FEET ON CENTER WITHIN EACH GROUP.				
BOTANICAL NAME	SPECIES NAME	PLANTING TYPE:	INDICATOR STATUS:	QUANTITY:
ASTER NOVI-BELGII	NEW YORK ASTER	PEAT POT/PLUG	FACW+	50
EUPATORIUM PERFOLIATUM	BONESET	PEAT POT/PLUG	FACW+	50
EUPATORIUM MACULATUM	SPOTTED JOE PYE	PEAT POT/PLUG	FACW	50
LOBELIA SIPHILITICA	BLUE LOBELIA	PEAT POT/PLUG	FACW+	50
VERNONIA NOVEBORACENSIS	NEW YORK IRONWEED	PEAT POT/PLUG	FACW+	50
WET MEADOW TREES		26,630 SQUARE FEET		
TREES TO BE SPACED IRREGULARLY IN WET MEADOW AREAS AVOIDING AREAS WITHIN FIVE (5) FEET OF FLOW PATH.				
BOTANICAL NAME	SPECIES NAME	PLANTING TYPE:	INDICATOR STATUS:	QUANTITY:
ACER SACCHARINUM	SILVER MAPLE	2 GALLON	FACW	10
BETULA NIGRA	RIVER BIRCH	2 GALLON	FACW	10
QUERCUS BICOLOR	SWAMP WHITE OAK	7 GALLON	FACW+	10
UPLAND MEADOW SEED		17,560 SQUARE FEET		
BOTANICAL NAME	SPECIES NAME	APPROXIMATE RATE (LBS PER LIVE SEED/ACRE)	INDICATOR STATUS:	
ASCLEPIAS SYRIACA	COMMON MILKWEED	1/4	NI	
ASTER LATERIFLORUS	CALICO ASTER	1/2	FACW-	
CHAMAECRISTA FASTICULATA	PARTIDGE PEA	1	FACU	
COREOPSIS LANCEOLATA	LANCE LEAVED COREOPSIS	10	FACU	
ELYMUS VIRGINICUS	VIRGINIA WILD RYE	15	FACW-	
PANICUM CLANDESTINUM	DEER TONGUE	2	FAC+	
PANICUM VIRGATUM	SWITCH GRASS	6	FAC	
POLYGONUM PENNSYLVANICUM	PA SMARTWEED	3	FACW	
RUDBECKIA TRILOBA	BROWN EYED SUSAN	1/4	FACU	
SCHIZACHRYRIUM SCOPARIUM	LITTLE BLUE STEM	6	FACU-	
SENNA HEBECARPA	WILD SENNA	10	FAC	
UPLAND MEADOW TREES		17,560 SQUARE FEET		
TREES TO BE SPACED IRREGULARLY ALONG BASIN EDGES IN UPLAND MEADOW AREAS.				
BOTANICAL NAME	SPECIES NAME	PLANTING TYPE:	INDICATOR STATUS:	QUANTITY:
LIQUIDAMBAR STYRACIFLUA	SWEET GUM	2 GALLON	FAC	10
NYSSA SYLVATICA	BLACK GUM	2 GALLON	FAC	10
QUERCUS PALUSTRIS	PIN OAK	3 GALLON	FACW	10



2 SHRUB CONTAINER PLANTING DETAIL
NOT TO SCALE





NOTES:

1. TO PREVENT DEER BROWSING, INSTALL TREE CAGES AS INDICATED IN DETAIL AROUND ALL TREES.

2. WHERE PRACTICAL, SURROUND CLOSELY GROUPED PLANTS WITH A SINGLE LENGTH OF FENCE.

3. USE (3) WIRE TIES TO FASTEN WIRE FENCE CLOSED.

1 TREE CAGE DETAIL
NOT TO SCALE

CALL BEFORE YOU DIG!
NEW JERSEY LAW REQUIRES
3 WORKING DAYS NOTICE FOR
CONSTRUCTION PHASE AND 10 WORKING
DAYS IN DESIGN STAGE – STOP CALL
NEW JERSEY ONE CALL SYSTEM, INC.
REFERENCE NEW JERSEY TITLE 48, CHPT. 2, ARTICLE 9
1-800-272-1000

PROJECT NOTES

GENERAL NOTES:

1. EXISTING CONDITIONS OBTAINED FROM SURVEY COMPLETED BY J. TIMOTHY KERNAN, INC. FROM NOVEMBER 17, 2010 THRU DECEMBER 23, 2010.
2. THE HORIZONTAL DATUM IS NORTH AMERICAN DATUM 1983 (NAD83) NEW JERSEY STATE PLANE (FIPS 2900). UNITS OF FEET.
3. THE VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM 1988(NAVD88). UNITS OF FEET.
4. NO WETLANDS DELINEATION WAS COMPLETED AS PART OF THIS TOPOGRAPHIC SURVEY. SEE PERMITTING GUIDANCE DOCUMENT.

DATE	DESCRIPTION

REVISIONS

STATE OF NEW JERSEY CERTIFICATE OF AUTH.
NO.: 24GA27976800

KEITHE J. MERL
Professional Engineer
NJ Lic. No. GE44839

DATE

PRINCETON HYDRO, LLC

SCIENTISTS AND ENGINEERS
120 EAST UWCHLAN AVENUE
SUITE 204
EXTON, PENNSYLVANIA 19341
PHONE. 610.524.4220
FAX. 610.524.9434
WWW.PRINCETONHYDRO.COM

PROJECT NAME/LOCATION:
WETLAND WATER QUALITY BASIN RETROFIT
AT STATION #32
MONROE TOWNSHIP
MIDDLESEX COUNTY, NEW JERSEY

DRAWING NAME:
PLANTING PLAN

DATE:	02/28/2010
PROJECT NO.:	0457.008
SCALE:	AS SHOWN
DRAWN BY:	LK
CHECKED BY:	KJM

SHEET NO.
3 OF 4

STANDARD FOR PERMANENT VEGETATIVE COVER FOR SOIL STABILIZATION

DEFINITION:

ESTABLISHMENT OF PERMANENT VEGETATIVE COVER ON EXPOSED SOILS WHERE PERENNIAL VEGETATION IS NEEDED FOR LONG TERM PROTECTION.

PURPOSE:

TO PERMANENTLY STABILIZE THE SOIL, ASSURING CONSERVATION OF SOIL AND WATER, AND TO ENHANCE THE ENVIRONMENT.

WATER QUALITY ENHANCEMENT:

SLOWS THE OVERLAND MOVEMENT OF STORMWATER RUNOFF, INCREASES INFILTRATION AND RETAINS SOIL AND NUTRIENTS ON SITE, PROTECTING STREAMS OR OTHER STORMWATER CONVEYANCES.

WHERE APPLICABLE:

ON EXPOSED SOILS

METHODS AND MATERIALS:

1. SITE PREPARATION

A. GRADE AS NEEDED AND FEASIBLE TO PERMIT THE USE OF CONVENTIONAL EQUIPMENT FOR SEEDBED PREPARATION, SEEDING, MULCH APPLICATION, AND MULCH ANCHORING. ALL GRADING SHOULD BE DONE IN ACCORDANCE WITH STANDARD FOR LAND GRADING ("STANDARDS FOR SOIL EROSION AND SEDIMENT CONTROL IN NEW JERSEY", THE NEW JERSEY STATE SOIL CONSERVATION COMMITTEE, JULY, 1999, PAGE 19-1.)

B. IMMEDIATELY PRIOR TO TOPSOILING, THE SURFACE SHOULD BE SCARIFIED 6 TO 12 INCHES. THIS WILL HELP ENSURE A GOOD BOND BETWEEN THE TOPSOIL AND SUBSOIL.

C. EMPLOY NEEDED EROSION CONTROL PRACTICES SUCH AS DIVERSIONS, GRADE STABILIZATION STRUCTURES, CHANNEL STABILIZATION MEASURES, SEDIMENTATION BASINS, AND WATERWAYS. SEE STANDARDS 11 THROUGH 42, "STANDARDS FOR SOIL EROSION AND SEDIMENT CONTROL IN NEW JERSEY", THE NEW JERSEY STATE SOIL CONSERVATION COMMITTEE, JULY 1999.

2. SEEDBED PREPARATION

A. APPLY GROUND LIMESTONE AND FERTILIZER ACCORDING TO SOIL TEST RECOMMENDATIONS SUCH AS OFFERED BY RUTGERS CO-OPERATIVE EXTENSION. SOIL SAMPLE MAILERS ARE AVAILABLE FROM THE LOCAL RUTGERS COOPERATIVE EXTENSION OFFICES. FERTILIZER SHALL BE APPLIED AT THE RATE OF 500 POUNDS PER ACRE OR 11 POUNDS PER 1,000 SQUARE FEET OF 10-20-10 OR EQUIVALENT WITH 50% WATER INSOLUBLE NITROGEN UNLESS A SOIL TEST INDICATES OTHERWISE. APPLY LIMESTONE IN ACCORDANCE WITH TABLE 4-1 AND THE RESULTS OF SOIL TESTING. CALCIUM CARBONATE IS THE EQUIVALENT AND STANDARD FOR MEASURING THE ABILITY OF LIMING MATERIALS TO NEUTRALIZE SOIL ACIDITY AND SUPPLY CALCIUM AND MAGNESIUM TO GRASSES AND LEGUMES. TABLE 4-1 IS A GENERAL GUIDELINE FOR LIMESTONE APPLICATION RATES.

B. WORK LIME AND FERTILIZER INTO THE SOIL AS NEARLY AS PRACTICAL TO A DEPTH OF 4 INCHES WITH A DISC, SPRINGTOOTH HARROW, OR OTHER SUITABLE EQUIPMENT. THE FINAL HARROWING OR DISCING OPERATION SHOULD BE ON THE GENERAL CONTOUR. CONTINUE TILLAGE UNTIL A REASONABLE UNIFORM SEEDBED IS PREPARED.

C. IMMEDIATELY PRIOR TO TOPSOILING, THE SURFACE SHOULD BE SCARIFIED 6 TO 12 INCHES WHERE THERE HAS BEEN SOIL COMPACTION. THIS WILL HELP ENSURE A GOOD BOND BETWEEN THE TOPSOIL AND SUBSOIL.

D. A UNIFORM APPLICATION TO A DEPTH OF 5 INCHES (UNSETTLED) IS RECOMMENDED. SOILS WITH A Ph OF 4.0 OR SHALL BE COVERED WITH A MINIMUM DEPTH OF 12 INCHES OF SOIL HAVING A pH OF 5.0 OR MORE, IN ACCORDANCE WITH THE STANDARD FOR MANAGEMENT OF HIGH ACID PRODUCING SOIL, ("STANDARDS FOR SOIL EROSION AND SEDIMENT CONTROL IN NEW JERSEY", THE NEW JERSEY STATE SOIL CONSERVATION COMMITTEE, JULY 1999, PAGE 1-1.)

3. SEEDING

A. SEE SHEET 2 OF 4 FOR PERMANENT SEED MIXTURE

1. SEEDING RATES SPECIFIED ARE REQUIRED WHEN A REPORT OF COMPLIANCE IS REQUESTED PRIOR TO ACTUAL ESTABLISHMENT OF PERMANENT VEGETATION. UP TO 50% REDUCTION IN RATES MAY BE USED WHEN PERMANENT VEGETATION IS ESTABLISHED PRIOR TO A REPORT OF COMPLIANCE INSPECTION. THESE RATES APPLY TO ALL METHODS OF SEEDING. ESTABLISHING PERMANENT VEGETATION MEANS 80% VEGETATIVE COVERAGE WITH THE SPECIFIED SEED MIXTURE FOR THE SEEDBED AREA AND MOWED ONCE.

B.

CONVENTIONAL SEEDING IS PERFORMED BY APPLYING SEED UNIFORMLY BY HAND, CYCLONE (CENTRIFUGAL) SEEDER, DROP SEEDER, DRILL OR CULTIPACKER. EXCEPT FOR DRILLED, HYDROSEEDED OR CULTIPACKED SEEDINGS, SEED SHALL BE INCORPORATED INTO THE SOIL WITHIN 24 HOURS OF SEEDBED PREPARATION TO A DEPTH OF 1/4 TO 1/2 INCH, BY RAKING OR DRAGGING. DEPTH OF SEED PLACEMENT MAY BE 1/4 INCH DEEPER ON COARSE TEXTURED SOIL.

C. **HYDROSEEDING** IS A BROADCAST SEEDING METHOD USUALLY INVOLVING A TRUCK OR TRAILER MOUNTED TANK, WITH AN AGITATION SYSTEM AND HYDRAULIC PUMP FOR MIXING SEED, WATER AND FERTILIZER AND SPRAYING THE MIX ONTO THE PREPARED SEEDBED. MULCH **SHALL NOT** BE INCLUDED IN THE TANK WITH SEED. SHORT FIBERED MULCH MAY BE APPLIED WITH A HYDROSEEDER FOLLOWING SEEDING. (ALSO SEE SECTION IV MULCHING BELOW) HYDROSEEDING IS **NOT PREFERRED SEEDING METHOD** BECAUSE SEED AND FERTILIZER ARE APPLIED TO THE SURFACE AND INCORPORATED INTO THE SOIL. POOR SEED TO SOIL CONTACT OCCURS REDUCING SEED GERMINATION AND GROWTH. HYDROSEEDING MAY BE USED FOR AREAS TO STEEP FOR CONVENTIONAL EQUIPMENT TO TRAVERSE OR TOO OBSTRUCTED WITH ROCKS, STUMPS, ETC.

D. AFTER SEEDING, FIRMING THE SOIL WITH A CORRUGATED ROLLER WILL ASSURE GOOD SEED TO SOIL CONTACT, RESTORE CAPILLARITY, AND IMPROVE SEEDLING EMERGENCE. **THIS IS THE PREFERRED METHOD**. WHEN PERFORMED ON THE CONTOUR, SHEET EROSION WILL BE MINIMIZED AND WATER CONSERVATION ON SITE WILL BE MAXIMIZED.

4. MULCHING

MULCHING IS REQUIRED ON ALL SEEDING. MULCH WILL INSURE AGAINST EROSION BEFORE GRASS IS ESTABLISHED AND WILL PROMOTE FASTER AND EARLIER ESTABLISHMENT. THE EXISTENCE OF VEGETATION SUFFICIENT TO CONTROL SOIL EROSION SHALL BE DEEMED IN COMPLIANCE WITH THIS MULCHING REQUIREMENT.

A. **STRAW OR HAY.** UNROTTED SMALL GRAIN STRAW, HAY FREE OF SEEDS, OR SALT HAY TO BE APPLIED AT THE RATE OF 1-1/2 TO 2 TONS PER ACRE (70 TO 90 POUNDS PER 1,000 SQUARE FEET), EXCEPT THAT WHERE A CRIMER IS USED INSTEAD OF LIQUID MULCH-BINDER (TACKIFYING OR ADHESIVE AGENT), THE RATE OF APPLICATION IS 3 TONS PER ACRE. MULCH CHOPPER-BLOWERS **MUST NOT** GRIND THE MULCH. HAY MULCH IS NOT RECOMMENDED FOR ESTABLISHING FINE TURF OR LAWNS DUE TO THE PRESENCE OF WEED SEED.
APPLICATION. SPREAD MULCH UNIFORMLY BY HAND OR MECHANICALLY SO THAT APPROXIMATELY 85% OF THE SOIL SURFACE WILL BE COVERED. FOR UNIFORM DISTRIBUTION OF HAND-SPREAD MULCH, DIVIDE AREA INTO APPROXIMATELY 1,000 SQUARE FEET SECTIONS AND DISTRIBUTE 70 TO 90 POUNDS WITHIN EACH SECTION.
ANCHORING. ANCHORING SHALL BE ACCOMPLISHED IMMEDIATELY AFTER PLACEMENT TO MINIMIZE LOSS BY WIND AND WATER. THIS MAY BE DONE BY ONE OF THE FOLLOWING METHODS, DEPENDING UPON THE SIZE OF THE AREA, STEEPNESS OF SLOPES, AND COSTS.

1. PEG AND TWINE. DRIVE 8 TO 10 INCH WOODEN PEGS TO WITHIN 2 TO 3 INCHES OF THE SOIL SURFACE EVERY 4 FEET IN ALL DIRECTIONS. STAKES MAY BE DRIVEN BEFORE OR AFTER APPLYING MULCH. SECURE MULCH TO SOIL SURFACE BY STRETCHING TWINE BETWEEN PEGS IN A CRISS-CROSS AND SQUARE PATTERN. SECURE TWINE AROUND EACH PEG WITH TWO OR MORE TURNS.

2. MULCH NETTINGS. STAPLE PAPER, JUTE, COTTON, OR PLASTIC NETTINGS TO THE SOIL SURFACE. USE A DEGRADABLE NETTING IN AREAS TO BE MOVED.

3. CRIMPER (MULCH ANCHORING COULTER TOOL, PREFERRED METHOD). A TRACTOR-DRAWN IMPLEMENT, SOMEWHAT LIKE A DISC HARROW, ESPECIALLY DESIGNED TO PUSH OR CUT SOME OF THE BROADCAST LON FIBER MULCH 3 TO 4 INCHES INTO THE SOIL SO AS TO ANCHOR IT AND LEAVE PART STANDING UPRIGHT. THIS TECHNIQUE IS LIMITED TO AREAS TRAVERSABLE BY A TRACTOR, WHICH MUST OPERATE ON THE CONTOUR OF SLOPES. STRAW MULCH RATE MUST BE 3 TONS PER ACRE. NO ADHESIVE AGENT IS REQUIRED.

4. LIQUID MULCH BINDERS. MAY BE USED TO ANCHOR SALT HAY, HAY AND STRAW MULCH.
   a. APPLICATIONS SHOULD BE HEAVIER AT EDGES WHERE WIND MAY CATCH THE MULCH, IN VALLEYS, AND AT CRESTS OF BANKS. THE REMAINDER OF THE AREA SHOULD BE UNIFORM IN APPEARANCE.
   b. USE ONE OF THE FOLLOWING:
      (1) ORGANIC AND VEGETABLE BASED BINDERS. NATURALLY OCCURRING, POWDER BASED, HYDROPHILIC MATERIALS WHEN MIXED WITH WATER FORMULATES A GEL AND WHEN APPLIED TO MULCH UNDER SATISFACTORY CURING CONDITIONS WILL FORM MEMBRANED NETWORKS OF INSOLUBLE POLYMERS. THE VEGETABLE GEL SHALL BE PHYSIOLOGICALLY HARMLESS AND NOT RESULT IN A PHYTOTOXIC EFFECT OR IMPEDE GROWTH OF TURFGRASS. USE AT A RATE AND WEATHER CONDITIONS AS RECOMMENDED BY THE MANUFACTURER TO ANCHOR MULCH MATERIALS. **MANY NEW PRODUCTS AREA AVAILABLE, SOME OF WHICH MAY NEED FURTHER EVALUATION FOR USE IN THIS STATE.**

      (2) SYNTHETIC BINDERS. HIGH POLYMER SYNTHETIC EMULSION, MISCIBLE WITH WATER WHEN DILUTED AND FOLLOWING APPLICATION TO MULCH, DRYING AND CURING SHALL NO LONGER BE SOLUBLE OR DISPERSIBLE IN WATER. IT SHALL BE APPLIED AT RATES RECOMMENDED BY THE MANUFACTURER AND REMAIN TACKY UNTIL GERMINATION OF GRASS.
      NOTE: NAMES GIVEN ABOVE ARE REGISTERED TRADE NAMES. THIS DOES NOT CONSTITUTE A RECOMMENDATION OF THESE PRODUCTS TO THE EXCLUSION OF OTHER PRODUCTS.

B. **WOOD FIBER OR PAPER FIBER MULCH.** SHALL BE MADE FROM WOOD, PLANT FIBERS OR PAPER CONTAINING NO GROWTH OR GERMINATION INHIBITING MATERIALS, USED AT THE RATE OF 1,500 POUNDS PER ACRE (OR AS RECOMMENDED BY THE PRODUCT MANUFACTURER) AND MAY BE APPLIED BY A HYDROSEEDER. THIS MULCH SHALL NOT BE MIXED IN THE TANK WITH SEED. USE IS **LIMITED** TO FLATTER SLOPES AND DURING OPTIMUM SEEDING PERIODS IN SPRING AND FALL.

C. **PELLETIZED MULCH.** COMPRESSED AND EXTRUDED PAPER AND/OR WOOD FIBER PRODUCT, WHICH MAY CONTAIN CO-POLYMERS, TACKIFIERS, FERTILIZERS AND COLORING AGENTS. THE DRY PELLETS, WHEN APPLIED TO A SEEDED AREA AND WATERED, FORM A MULCH MAT. PELLETIZED MULCH SHALL BE APPLIED IN ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATIONS. MULCH MAY BE APPLIED BY HAND OR MECHANICAL SPREADER AT THE RATE OF 60-75 POUNDS PER 1,000 SQUARE FEET AND ACTIVATED WITH 0.2 TO 0.4 INCHES OF WATER. THIS MATERIAL HAS BEEN FOUND TO BE BENEFICIAL FOR USE ON SMALL LAWN OR RENOVATION AREAS, SEEDED AREAS WHERE WEED-SEED FREE MULCH IS DESIRED OR ON SITES WHERE STRAW MULCH AND TACKIFIER AGENT ARE NOT PRACTICAL OR DESIRABLE. APPLYING THE FULL 0.2 TO 0.4 INCHES OF WATER AFTER SPREADING PELLETIZED MULCH ON THE SEED BED IS EXTREMELY IMPORTANT FOR SUFFICIENT AND EXPANSION OF THE MULCH TO PROVIDE SOIL COVERAGE.

STANDARD FOR PERMANENT VEGETATIVE COVER FOR SOIL STABILIZATION (CONT.)

5. IRRIGATION

IF SOIL IS DEFICIENT, AND MULCH IS NOT USED, SUPPLY NEW SEEDINGS WITH ADEQUATE WATER (A MINIMUM OF 1/4 INCH TWICE A DAY UNTIL VEGETATION IS WELL ESTABLISHED). THIS IS ESPECIALLY TRUE WHEN SEEDINGS ARE MADE IN ABNORMALLY DRY OR HOT WEATHER OR ON DROUGHTY SITES.

6. TOPDRESSING

NO FOLLOW-UP OF TOPDRESSING IS MANDATORY. AN EXCEPTION MAY BE WHERE GROSS NITROGEN DEFICIENCY EXISTS TO THE EXTENT THAT TURF FAILURE MAY DEVELOP. IN THAT INSTANCE, TOPDRESS WITH 10-10-10 OR EQUIVALENT AT 400 POUNDS PER 1,000 SQUARE FEET.

7. ESTABLISHING PERMANENT VEGETATIVE STABILIZATION

THE QUALITY OF PERMANENT VEGETATION RESTS WITH THE CONTRACTOR. THE TIMING OF SEEDING, PREPARATION THE SEEDBED, APPLYING NUTRIENTS, IRRIGATION, MULCH AND OTHER MANAGEMENT ARE ESSENTIAL. THE SEED APPLICATION RATES IN TABLE 4-3 ARE REQUIRED WHEN A **REPORT OF COMPLIANCE** IS REQUESTED PRIOR TO ACTUAL ESTABLISHMENT OF PERMANENT VEGETATION. UP TO 50% REDUCTION IN APPLICATION RATES MAY BE USED WHEN PERMANENT VEGETATION IS ESTABLISHED PRIOR TO REQUESTING A **REPORT OF COMPLIANCE** FROM THE DISTRICT. THESE RATES APPLY TO ALL METHODS OF SEEDING. **ESTABLISHING PERMANENT VEGETATION MEANS 80% VEGETATIVE COVER (OF THE SEEDED SPECIES) AND MOWED ONCE.**

PERMANENT VEGETATIVE SEED MIXTURE FOR SOIL STABILIZATION FOR SOIL DISPOSAL LOCATION

REFER TO SHEET 2 OF 4 FOR PERMANENT SEED MIXTURE AND PLANTING PLAN

STANDARD FOR LAND GRADING

DEFINITION:

RESHAPING THE GROUND SURFACE BY GRADING TO PLANNED ELEVATIONS WHICH ARE DETERMINED BY TOPOGRAPHIC SURVEY AND LAYOUT.

PURPOSE:

IMPROVE SURFACE DRAINAGE AND CONTROL EROSION.

CONDITIONS WHERE PRACTICES APPLIES:

THIS PRACTICE IS APPLICABLE WHERE GRADING TO PLANNED ELEVATIONS IS PRACTICAL AND IT IS DETERMINED THAT GRADING IS NEEDED. GRADING THAT INVOLVES THE DISTURBANCE OF VEGETATION OVER LARGE AREAS SHALL BE AVOIDED. IT MAY BE NECESSARY TO PROVIDE TEMPORARY STABILIZATION OVER LARGE AREAS.

WATER QUALITY ENHANCEMENT:

PROPER GRADING OF DISTURBED SOILS WILL PROTECT AGAINST SOIL LOSS FROM EROSION, ENHANCE ESTABLISHMENT OF PERMANENT VEGETATIVE COVER AND HELP TO PROPERLY MANAGE STORMWATER RUNOFF ALL OF WHICH WILL REDUCE OFFSITE DISCHARGE OF POLLUTANTS.

PLANNING CRITERIA:

EROSION CONTROL MEASURES SHALL BE INSTALLED IN ACCORDANCE WITH THE APPLICABLE STANDARD CONTAINED HEREIN. THE CUT FACE OF EARTH EXCAVATIONS AND FILLS SHALL BE NO STEEPER THAN THE SAFE ANGLE OF REPOSE FOR THE MATERIALS ENCOUNTERED AND FLAT ENOUGH FOR MAINTENANCE AND WILL BE NO GREATER THAN TWO (2) HORIZONTAL TO ONE (1) VERTICAL IN ANY SITUATION. PERMANENTLY EXPOSED FACES OF EARTH CUTS AND FILLS SHALL BE VEGETATED OR OTHERWISE PROTECTED EROSION. PROVISIONS SHALL BE MADE TO SAFELY CONDUCT SURFACE WATER TO STORM DRAINS OR SUITABLE WATER COURSES AND PREVENT SURFACE RUNOFF FROM DAMAGING CUT FACES AND FILL SLOPES. ADJACENT PROPERTIES SHALL BE PROTECTED FROM EXCAVATION AND FILLING OPERATIONS.

STANDARD FOR DUST CONTROL

PURPOSE:

THE CONTROL OF DUST ON CONSTRUCTION SITES AND ROADS.

DEFINITION:

TO PREVENT BLOWING AND MOVEMENT OF DUST FROM EXPOSED SOIL SURFACES, REDUCED ON-SITE AND OFF-SITE DAMAGE AND HEALTH HAZARDS, AND IMPROVE TRAFFIC SAFETY.

WATER QUALITY ENHANCEMENT:

SEDIMENTS DEPOSITED AS "DUST" ARE OFTEN FINE COLLOIDAL MATERIAL WHICH IS EXTREMELY DIFFICULT TO REMOVE FROM WATER ONCE IT BECOMES SUSPENDED. USE OF THIS STANDARD WILL HELP TO CONTROL THE GENERATION OF DUST FROM CONSTRUCTION SITES AND SUBSEQUENT BLOWING AND DEPOSITION INTO LOCAL SURFACE WATER RESOURCES.

CONDITIONS WHERE PRACTICES APPLIES:

THIS PRACTICE IS APPLICABLE TO AREAS SUBJECT TO DUST BLOWING AND MOVEMENT WHERE ON-SITE AND OFF-SITE DAMAGE IS LIKELY WITHOUT TREATMENT. CONSULT WITH LOCAL MUNICIPAL ORDINANCES ON ANY RESTRICTIONS.

THE FOLLOWING METHODS SHOULD BE CONSIDERED FOR CONTROLLING DUST:

SPRAY-ON ADHESIVES: ON MINERAL SOILS (NOT EFFECTIVE ON MUCK SOILS). KEEP TRAFFIC OFF THESE AREAS.

PLANNING CRITERIA:

MATERIAL GALLONS/ACRE	WATER DILUTION	TYPE OF NOZZLE	APPLY
ANIONIC ASPHALT EMULSION	7:1	COARSE SPRAY	1200
LATEX EMULSION	12.5:1	FINE SPRAY	235
RESIN IN WATER	4:1	FINE SPRAY	300
POLYACRYLAMIDE (PAM) - SPRAY ON			
POLYACRYLAMIDE (PAM) - DRY SPREAD			
ACIDEULATED SOY BEAN SOAP STICK	NONE	COARSE SPRAY	1200

APPLY ACCORDING TO MANUFACTURER'S INSTRUCTIONS. MAY ALSO BE USED AS AN ADDITIVE TO SEDIMENT BASINS TO FLOCCULATE AND PRECIPITATE SUSPENDED COLLOIDS.

TILLAGE: TO ROUGHEN SURFACE AND BRING CLODS TO THE SURFACE. THIS IS A TEMPORARY EMERGENCY MEASURE WHICH SHOULD BE USED BEFORE SOIL BLOWING STARTS. BEGIN PLOWING ON WINDWARD SIDE OF SITE. CHISEL-TYPE PLOWS SPACED ABOUT 12 INCHES APART, AND SPRING TOOTHED HARROWS ARE EXAMPLES OF EQUIPMENT WHICH MAY PRODUCE THE DESIRED EFFECT.

SPRINKLING: BROADCAST APPLICATION OF WATER UNTIL THE SURFACE IS WET.

BARRIERS: SOLID BOARD FENCES, SNOW FENCES, BURLAP FENCES, CRATE WALLS, BALES OF HAY, AND SIMILAR MATERIAL CAN BE USED TO CONTROL AIR CURRENTS AND SOIL BLOWING.

CALCIUM CHLORIDE: SHALL BE IN THE FORM OF LOOSE, DRY GRANULES OR FLAKES FINE ENOUGH TO FEED THROUGH COMMONLY USED SPREADERS AT A RATE THAT WILL KEEP SURFACE MOIST BUT NOT CAUSE POLLUTION OR PLANT DAMAGE. IF USED ON STEEPER SLOPES, THEN USE OTHER PRACTICES TO PREVENT WASHING INTO STREAMS, OR ACCUMULATION AROUND PLANTS. NOT TO BE USED IN RETROFIT AREA, APPLICABLE ONLY TO UPLAND AREAS

STONE: COVER SURFACE WITH CRUSHED STONE OR COARSE GRAVEL.

TABLE 4-1

LIMESTONE[1] APPLICATION RATE BY SOIL TEXTURE	
SOIL TEXTURE	TONS / ACRE
CLAY, CLAY LOAM, AND HIGH ORGANIC SOIL	3
SANDY LOAM, LOAM, SILT LOAM	2
LOAMY SAND, SAND	1

1 PULVERIZED DOLOMITIC LIMESTONE IS PREFERRED FOR MOST SOILS SOUTH OF THE NEW BRUNSWICK - TRENTON LINE.

STANDARD FOR MANAGEMENT OF HIGH ACID PRODUCING SOILS

DEFINITION

IDENTIFYING HIGH ACID PRODUCING SOIL WHICH MAY BE EXPOSED DURING EXCAVATION AND LAND GRADING ACTIVITIES AND PRACTICES FOR ITS BURIAL. HIGH ACID PRODUCING SOILS ARE SOIL WITH A PH OF 4 OR LESS OR CONTAIN IRON SULFIDE.

PURPOSE

TO PREVENT OR LIMIT EXPOSURE, EXPOSURE TIME AND SPREADING BY EQUIPMENT OR RAINFALL ON AND OFF SITE AND MINIMIZE EROSION, SEDIMENTATION AND ACID LEACHATE RELATED DAMAGES.

BY ITS EXPOSURE TO AIR, SOILS CONTAINING IRON SULFIDE, CHARACTERIZED BY PYRITE OR MARCASITE NUGGETS OR GREEN SANDS, CAUSES CHEMICAL OXIDATION TO OCCUR PRODUCING SULFURIC ACID AND RESULTS IN SOIL PH LEVELS FALLING TO PH 3 AND LOWER. MOST VEGETATION IS INCAPABLE OF GROWTH AT THIS PH LEVEL. ADJACENT LAND AND RECEIVING WATERS WILL BE NEGATIVELY IMPACTED BY THE ACID LEACHATE. CALCIUM CONTAINING MATERIALS SUCH AS SIDEWALKS, CULVERTS AND OTHER STRUCTURES AND SOME METALLIC MATERIALS ARE ALSO SUSCEPTIBLE TO DEGRADATION. AGRICULTURAL LIMESTONE MATERIALS APPLIED AT RATES OF 8 TONS PER ACRE HAVE RESULTED IN ONLY A TEMPORARY BUFFERING EFFECT AN "LIMING-ONLY" IS THEREFORE NOT CONSIDERED AN ACCEPTABLE MITIGATION PRACTICE.

WATER QUALITY ENHANCEMENT

PROTECTS ON SITE SOILS AND OFFSITE STREAMS AND LAKES FROM SULFURIC ACID LEACHATE WHICH CREATES SOIL PH CONDITIONS UNSUITABLE FOR GROWTH OF VEGETATION.

WHERE APPLICABLE

THIS PRACTICE IS APPLICABLE TO ANY HIGH ACID PRODUCING SOIL MATERIALS. SUCH MATERIALS HAVE BEEN FOUND IN THE COASTAL PLAIN AREAS OF BURLINGTON, CAMDEN, MERCER, MIDDLESEX, MONMOUTH, OCEAN AND SALEM COUNTIES.

PLANNING CRITERIA

EARLY RECOGNITION AND BURIAL, REMOVAL OR DISPOSAL OF HIGH ACID PRODUCING SOILS IS ESSENTIAL FOR LIMITING THE AMOUNT OF ACIDIC MATERIAL PRODUCED.

REVIEW A SURFACE GEOLOGY MAP FOR THE PROPOSED SITE TO INVESTIGATE THE PRESENCE OF GEOLOGIC FORMATIONS WHICH COMMONLY CONTAIN HIGH ACID PRODUCING DEPOSITS. THE GEOLOGIC FORMATIONS ARE AS FOLLOWS:

ENGLISHTOWN SAND	NAVESINK FORMATION
KIRKWOOD FORMATION	RARITAN FORMATION
MAGOTHY FORMATION	RED BANK SAND
MARSHALLTOWN FORMATION	WOODBURY CLAY
MERCHANTVILLE FORMATION	

CONTACT THE LOCAL SOIL CONSERVATION DISTRICT TO DETERMINE THE HISTORICAL PRESENCE OF HIGH ACID PRODUCING SOILS IN THE VICINITY OF THE PROPOSED SITE.

HIGH ACID PRODUCING SOILS MAY BE PRESENT IN UNDISTURBED SOILS AT VARYING DEPTHS INCLUDING NEAR THE SOIL SURFACE TO EXCAVATIONS OR DEEP DISTURBANCES. ITS PRESENCE ON A SITE MAY BE SIGNIFICANT OR LIMITED IN THE SOIL PROFILE. HIGH ACID PRODUCING SOILS ARE COMMONLY BLACK, DARK BROWN, GRAY OR GREENISH WITH SILVERY PYRITE OR MARCASITE NUGGETS OR FLAKES.

ALTERNATIVELY, SANDY SOILS OF REDDISH, YELLOWISH OR LIGHT TO MEDIUM BROWN SOIL MATERIALS ARE USUALLY FREE OF HIGH ACID PRODUCING DEPOSITS.

METHODS AND MATERIALS

1. LIMIT THE EXCAVATION AREA AND EXPOSURE TIME WHEN HIGH ACID PRODUCING SOILS ARE ENCOUNTERED.
2. TOPSOIL STRIPPED FROM THE SITE SHALL BE STORED SEPARATELY FROM TEMPORARILY STOCKPILED HIGH ACID PRODUCING SOILS.
3. STOCKPILES OF HIGH ACID PRODUCING SOIL SHOULD BE LOCATED ON LEVEL LAND TO MINIMIZE ITS MOVEMENT, ESPECIALLY WHEN THIS MATERIAL HAS HIGH CLAY CONTENT.
4. TEMPORARILY STOCKPILED HIGH ACID PRODUCING SOIL MATERIAL TO BE EXPOSED MORE THAN 30 DAYS SHOULD BE COVERED WITH PROPERLY ANCHORED, HEAVY GRADE SHEETS OF POLYETHYLENE WHERE POSSIBLE. IF NOT POSSIBLE, STOCKPILES SHALL BE COVERED WITH A MINIMUM OF 3 TO 6 INCHES OF WOOD CHIPS TO MINIMIZE EROSION OF THE STOCKPILE. SILT FENCE SHALL BE INSTALLED AT THE TOE OF SLOPE TO CONTAIN MOVEMENT OF THE STOCKPILED MATERIAL. TOPSOIL SHALL NOT BE APPLIED TO THE STOCKPILES TO PREVENT TOPSOIL CONTAMINATION WITH HIGH ACID PRODUCING SOIL.
5. HIGH ACID PRODUCING SOILS WITH A PH OF 4 OR LESS, OR CONTAINING IRON SULFIDE, (INCLUDING BORROW FROM CUTS) SHALL BE ULTIMATELY PLACED OR BURIED WITH LIMESTONE APPLIED AT THE RATE OF 6 TONS PER ACRE (OR 275 POUNDS PER 1,000 SQUARE FEET OF SURFACE AREA) AND COVERED WITH A MINIMUM OF 12 INCHES OF SETTLED SOIL WITH A PH OF 5 OR MORE EXCEPT AS FOLLOWS:
   a. AREAS WHERE TREES OR SHRUBS ARE TO BE PLANTED SHALL BE COVERED WITH A MINIMUM OF 24 INCHES OF SOIL WITH A PH OF 5 OR MORE.
   b. DISPOSAL AREAS SHALL NOT BE LOCATED WITHIN 24 INCHES OF ANY SURFACE OF A SLOPE OR BANK, SUCH AS BERMS, STREAM BANKS, DITCHES AND OTHERS TO PREVENT POTENTIAL LATERAL LEACHING DAMAGES.
6. EQUIPMENT USED FOR MOVEMENT OF HIGH ACID PRODUCING SOILS SHOULD BE CLEANED AT THE END OF EACH DAY TO PREVENT SPREADING OF HIGH ACID SOIL MATERIALS TO OTHERS PARTS OF THE SITE, INTO STREAMS OR STORMWATER CONVEYANCES AND TO PROTECT MACHINERY FROM ACCELERATED RUSTING.
7. NON VEGETATIVE EROSION CONTROL PRACTICES (STONE TRACKING PADS, STRATEGICALLY PLACED LIMESTONE CHECK DAM, SILT FENCE, WOOD CHIPS) SHOULD BE INSTALLED TO LIMIT THE MOVEMENT OF HIGH ACID PRODUCING SOILS FROM, AROUND OR OFF THE SITE.
8. FOLLOWING BURIAL OR REMOVAL OF HIGH ACID PRODUCING SOIL, TOPSOILING AND SEEDING OF THE SITE, (SEE TEMPORARY VEGETATIVE COVER FOR SOIL STABILIZATION, PERMANENT VEGETATIVE COVER FOR SOIL STABILIZATION, AND TOPSOILING) MONITORING SHOULD CONTINUE FOR APPROXIMATELY 6 TO 12 MONTHS TO ASSURE THERE IS ADEQUATE STABILIZATION AND THAT NO HIGH ACID SOIL PROBLEMS EMERGE. IF PROBLEMS STILL EXIST THE AFFECTED AREA MUST BE TREATED AS INDICATED ABOVE TO CORRECT THE PROBLEM.
9. MONITORING OF AREAS WHERE HIGH ACID PRODUCING SOIL HAS BEEN PLACED OR BURIED SHOULD BE PERFORMED FOR AT LEAST 2 YEARS OR LONGER IF PROBLEMS OCCUR, TO ASSURE THERE IS NO MIGRATION OF POTENTIAL ACID LEACHATE.

FREEHOLD SOIL EROSION AND SEDIMENT CONTROL NOTES:

1. THE FREEHOLD SOIL CONSERVATION DISTRICT SHALL BE NOTIFIED SEVENTY-TWO (72) HOURS IN ADVANCE OF ANY LAND DISTURBING ACTIVITY.
2. ALL WORK IS TO BE DONE IN ACCORDANCE WITH THE STATE STANDARDS FOR SOIL EROSION AND SEDIMENT CONTROL OF NEW JERSEY.
3. ALL SOIL EROSION AND SEDIMENT CONTROL PRACTICES ARE TO BE INSTALLED PRIOR TO ANY MAJOR SOIL DISTURBANCE, OR IN THEIR PROPER SEQUENCE, AND MAINTAINED UNTIL PERMANENT PROTECTION IS ESTABLISHED.
4. ANY CHANGES TO THE CERTIFIED SOIL EROSION AND SEDIMENT CONTROL PLANS WILL REQUIRE THE SUBMISSION OF REVISED SOIL EROSION AND SEDIMENT CONTROL PLANS TO THE DISTRICT FOR RE-CERTIFICATION. THE REVISED PLANS MUST MEET ALL CURRENT STATE SOIL EROSION AND SEDIMENT CONTROL STANDARDS.
5. IN THAT NJSA 4:24-39 ET. SEQ. REQUIRES THAT NO CERTIFICATES OF OCCUPANCY BE ISSUED BEFORE THE PROVISIONS OF THE CERTIFIED PLAN FOR EROSION CONTROL HAVE BEEN COMPLIED WITH FOR PERMANENT MEASURES. ALL SITE WORK AND ALL WORK AROUND INDIVIDUAL LOTS IN SUBDIVISIONS, WILL HAVE TO BE COMPLETED PRIOR TO THE DISTRICT ISSUING A REPORT OF COMPLIANCE FOR THE ISSUANCE OF A CERTIFICATE OF OCCUPANCY BY THE MUNICIPALITY.
6. ANY DISTURBED AREAS THAT WILL BE LEFT EXPOSED MORE THAN THIRTY (30) DAYS, AND NOT SUBJECT TO CONSTRUCTION TRAFFIC, WILL IMMEDIATELY RECEIVE A TEMPORARY SEEDING. IF THE SEASON PREVENTS THE ESTABLISHMENT OF TEMPORARY COVER, THE DISTURBED AREAS WILL BE MULCHED WITH STRAW, OR EQUIVALENT MATERIAL, AT A RATE OF 2 TO 2 $\frac{1}{2}$ TONS PER ACRE, ACCORDING TO STATE STANDARD FOR STABILIZATION WITH MULCH ONLY.
7. IMMEDIATELY FOLLOWING INITIAL DISTURBANCE OR ROUGH GRADING, ALL CRITICAL AREAS SUBJECT TO EROSION (I.E. STEEP SLOPES AND ROADWAY EMBANKMENTS) WILL RECEIVE TEMPORARY SEEDING IN COMBINATION WITH STRAW MULCH OR A SUITABLE EQUIVALENT, AT A RATE OF 1 1/2 TO 2 TONS PER ACRE, ACCORDING TO STATE STANDARDS.
8. A SUB-BASE COURSE WILL BE APPLIED IMMEDIATELY FOLLOWING ROUGH GRADING AND INSTALLATION OF IMPROVEMENTS TO STABILIZE STREETS, ROADS, DRIVEWAYS, AND PARKING AREAS. IN AREAS WHERE NO UTILITIES ARE PRESENT, THE SUB-BASE SHALL BE INSTALLED WITHIN FIFTEEN (15) DAYS OF THE PRELIMINARY GRADING.
9. ANY STEEP SLOPES RECEIVING PIPELINE INSTALLATION WILL BE BACKFILLED AND STABILIZED DAILY, AS THE INSTALLATION CONTINUES (I.E. SLOPES GREATER THAN 3:1).
10. THE STANDARD FOR STABILIZED CONSTRUCTION ACCESS REQUIRES THE INSTALLATION OF A PAD OF CLEAN CRUSHED STONE AT POINTS WHERE TRAFFIC WILL BE ACCESSING THE CONSTRUCTION SITE. AFTER INTERIOR ROADWAYS ARE PAVED, INDIVIDUAL LOTS REQUIRE A STABILIZED CONSTRUCTION ENTRANCE CONSISTING OF ONE INCH TO TWO INCH (1"-2") STONE FOR A MINIMUM LENGTH OF TEN FEET (10') EQUAL TO THE LOT ENTRANCE WIDTH. ALL OTHER ACCESS POINTS SHALL BE BLOCKED OFF.
11. ALL SOIL WASHED, DROPPED, SPILLED, OR TRACKED OUTSIDE THE LIMIT OF DISTURBANCE OR ONTO PUBLIC RIGHT-OF-WAYS WILL BE REMOVED IMMEDIATELY.
12. PERMANENT VEGETATION IS TO BE SEEDED OR SODDED ON ALL EXPOSED AREAS WITHIN TEN (10) DAYS AFTER FINAL GRADING.
13. AT THE TIME THAT SITE PREPARATION FOR PERMANENT VEGETATIVE STABILIZATION IS GOING TO BE ACCOMPLISHED, ANY SOIL THAT WILL NOT PROVIDE A SUITABLE ENVIRONMENT TO SUPPORT ADEQUATE VEGETATIVE GROUND COVER SHALL BE REMOVED OR TREATED IN SUCH A WAY THAT IT WILL PERMANENTLY ADJUST THE SOIL CONDITIONS AND RENDER IT SUITABLE FOR VEGETATIVE GROUND COVER. IF THE REMOVAL OR TREATMENT OF THE SOIL WILL NOT PROVIDE SUITABLE CONDITIONS, NON-VEGETATIVE MEANS OF PERMANENT GROUND STABILIZATION WILL HAVE TO BE EMPLOYED.
14. IN ACCORDANCE WITH THE STANDARD FOR MANAGEMENT OF HIGH ACID PRODUCING SOILS, ANY SOIL HAVING A PH OF 4 OR LESS OR CONTAINING IRON SULFIDES SHALL BE COVERED WITH A MINIMUM OF TWELVE (12) INCHES OF SOIL HAVING A PH OF 5 OR MORE PRIOR TO SEEDBED PREPARATION. AREAS WHERE TREES OR SHRUBS ARE TO BE PLANTED SHALL BE COVERED WITH A MINIMUM OF TWENTY- FOUR (24) INCHES OF SOIL HAVING A PH OF 5 OR MORE.
15. CONDUIT OUTLET PROTECTION MUST BE INSTALLED AT ALL REQUIRED OUTFALLS PRIOR TO THE DRAINAGE SYSTEM BECOMING OPERATIONAL.
16. UNFILTERED DEWATERING IS NOT PERMITTED. NECESSARY PRECAUTIONS MUST BE TAKEN DURING ALL DEWATERING OPERATIONS TO MINIMIZE SEDIMENT TRANSFER. ANY DEWATERING METHODS USED MUST BE IN ACCORDANCE WITH THE STANDARD FOR DEWATERING.
17. SHOULD THE CONTROL OF DUST AT THE SITE BE NECESSARY, THE SITE WILL BE SPRINKLED UNTIL THE SURFACE IS WET, TEMPORARY VEGETATIVE COVER SHALL BE ESTABLISHED OR MULCH SHALL BE APPLIED AS REQUIRED BY THE STANDARD FOR DUST CONTROL.
18. STOCKPILE AND STAGING LOCATIONS ESTABLISHED IN THE FIELD SHALL BE PLACED WITHIN THE LIMIT OF DISTURBANCE ACCORDING TO THE CERTIFIED PLAN. STAGING AND STOCKPILES NOT LOCATED WITHIN THE LIMIT OF DISTURBANCE WILL REQUIRE CERTIFICATION OF A REVISED SOIL EROSION AND SEDIMENT CONTROL PLAN. CERTIFICATION OF A NEW SOIL EROSION AND SEDIMENT CONTROL PLAN MAY BE REQUIRED FOR THESE ACTIVITIES IF AN AREA GREATER THAN 5,000 SQUARE FEET IS DISTURBED.
19. ALL SOIL STOCKPILES ARE TO BE TEMPORARILY STABILIZED IN ACCORDANCE WITH SOIL EROSION AND SEDIMENT CONTROL NOTE #6.
20. THE PROPERTY OWNER SHALL BE RESPONSIBLE FOR ANY EROSION OR SEDIMENTATION THAT MAY OCCUR BELOW STORMWATER OUTFALLS OR OFFSITE AS A RESULT OF CONSTRUCTION OF THE PROJECT.

CALL BEFORE YOU DIG!
NEW JERSEY LAW REQUIRES
3 WORKING DAYS NOTICE FOR
CONSTRUCTION PHASE AND 10 WORKING
DAYS IN DESIGN STAGE – STOP CALL
NEW JERSEY ONE CALL SYSTEM, INC.
REFERENCE NEW JERSEY TITLE 48, CHPT. 2, ARTICLE 9
1-800-272-1000

PROJECT NOTES

GENERAL NOTES:

1. 72 HOURS PRIOR TO ANY SOIL DISTURBANCE, NOTICE IN WRITING, SHALL BE GIVEN TO THE FREEHOLD SOIL CONSERVATION DISTRICT.

DATE	DESCRIPTION

REVISIONS

STATE OF NEW JERSEY CERTIFICATE OF AUTH. NO.: 24GA27976800

KEITHE J. MERL
Professional Engineer
NJ Lic. No. GE44839

DATE

PRINCETON HYDRO, LLC
SCIENTISTS AND ENGINEERS
120 EAST UWCHLAN AVENUE
SUITE 204
EXTON, PENNSYLVANIA 19341
PHONE. 610.524.4220
FAX. 610.524.9434
WWW.PRINCETONHYDRO.COM

PROJECT NAME/LOCATION:
WETLAND WATER QUALITY BASIN RETROFIT
AT STATION #32
MONROE TOWNSHIP
MIDDLESEX COUNTY, NEW JERSEY

DRAWING NAME:
EROSION AND
SEDIMENT CONTROL
NOTES

DATE:	02/28/2011
PROJECT NO.:	0457.008
SCALE:	NOT TO SCALE
DRAWN BY:	JEO
CHECKED BY:	KJM

SHEET NO.
4 OF 4

MANALAPAN LAKE
SHORELINE STABILIZATION

AT STATION #37, THOMPSON PARK,
MONROE TOWNSHIP AND JAMESBURG BOROUGH
BLOCK 59, LOT 3
MIDDLESEX COUNTY, NEW JERSEY

GENERAL NOTES:

1. ALL ELEVATIONS AND QUANTITIES ARE BASED ON IN-SITU CONDITIONS. ONCE DISTURBED, MATERIAL CONDITIONS CAN VARY SIGNIFICANTLY.
2. THE APPROVAL AND USE OF THESE PLANS ARE FOR THE PROJECT OWNER. THIS PLAN IS NOT TO BE UTILIZED IN THE PREPARATION OF ANY OTHER PROJECTS.
3. AS FIELD CONDITIONS MAY REQUIRE MODIFICATIONS TO PROPOSED TOPOGRAPHIC ELEVATIONS AND FACILITY LOCATIONS, THESE PLANS ARE NOT TO BE UTILIZED FOR AS-BUILTS OR FOR PURPOSES OTHER THAN STATED HEREIN.
4. THESE PLANS ARE NOT TO BE UTILIZED FOR CONSTRUCTION, UNTIL ALL REQUIRED LOCAL, STATE, AND FEDERAL PERMITS ARE OBTAINED.

CONSTRUCTION NOTES:

1. SOIL, ROCK, OR OTHER MATERIALS TO BE UTILIZED FOR FILLING OR BACKFILLING SHALL BE APPROVED BY A QUALIFIED GEOTECHNICAL ENGINEER.
2. ALL MATERIALS SHALL CONFORM TO THE LATEST AMERICAN STANDARDS FOR TESTING AND MATERIALS SPECIFICATIONS (ASTM).
3. PROXIMITY OF STOCKPILES TO THE EDGE OF EXCAVATIONS SHALL BE SUCH THAT THE INFLUENCE OF THE STOCKPILE SURCHARGE ON THE MODIFIED OR EXISTING SLOPE IS REDUCED. WHERE POSSIBLE STOCKPILES WILL BE PLACED A DISTANCE FROM THE EDGE OF EXCAVATION EQUAL TO (OR GREATER THAN) THE HEIGHT OF THE EXCAVATION.
4. ALL STOCKPILED MATERIAL PROPOSED FOR USE WILL BE PROTECTED FROM EXCESSIVE LOSS OR GAIN OF MOISTURE USING SECURELY ANCHORED PLASTIC COVERS OR EQUIVALENT METHODS.
5. UTILITIES SHALL BE LOCATED BY THE CONTRACTOR PRIOR TO CONSTRUCTION.
6. NECESSARY PRECAUTIONS SHALL BE TAKEN BY THE CONTRACTOR TO PROTECT EXISTING SERVICES AND MAINS. ANY DAMAGE TO EXISTING SERVICES OR MAINS SHALL BE REPAIRED IMMEDIATELY AT THE CONTRACTOR'S EXPENSE.
7. EXCAVATIONS AND STOCKPILES IN NO WAY SHALL HAVE SLOPES STEEPER THAN 2:1.
8. THE CONTRACTOR SHALL NOTE THAT IN THE CASE OF A DISCREPANCY BETWEEN THE SCALED AND THE FIGURED DIMENSIONS SHOWN ON THESE PLANS, THE FIGURED DIMENSIONS SHALL APPLY.
9. IT SHALL BE DISTINCTLY UNDERSTOOD THAT FAILURE TO MENTION SPECIFICALLY ANY WORK THAT WOULD NORMALLY BE REQUIRED TO COMPLETE THE PROJECT, SHALL NOT RELIEVE THE CONTRACTOR OF RESPONSIBILITY TO PERFORM THE WORK.
10. IT SHALL BE THE CONTRACTORS RESPONSIBILITY TO ASSURE THE ACCURACY OF THE PROPERTY BOUNDARIES.
11. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE REPAIR AND REPLACEMENT OF PROPERTY DAMAGE TO FENCES, SIGNS, STRUCTURES, VEGETATION, IRRIGATION, LANDSCAPING COMPONENTS, AND ANY OTHER PROPERTY ITEMS THAT ARE REMOVED FOR THE PURPOSES OF THE PROJECT LOGISTICS AND ACCIDENTS.
12. EXISTING ASPHALT SURFACES SHALL REMAIN UNDISTURBED EXCEPT FOR THE PROPOSED WORK AS CALLED FOR ON THESE PLANS. ANY DAMAGE TO THESE ASPHALT SURFACES SHALL BE THE SOLE RESPONSIBILITY OF THE CONTRACTOR AND ALL COSTS FOR REPAIRS SHALL BE BORNE BY THE CONTRACTOR.
13. THE CONTRACTOR SHALL PROVIDE NECESSARY MAINTENANCE AND PROTECTION OF TRAFFIC MEASURES. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO PROVIDE TRAFFIC CONTROL FOR THE ADJACENT PARKING LOT AREA.
14. THIS PROJECT IS LOCATED WITHIN THE MAGOTHY GEOLOGIC FORMATION WHICH IS LIKELY TO CONTAIN ACID PRODUCING SOILS.
15. CONTRACTOR IS RESPONSIBLE FOR THE CORRECTION OF ANY EROSION OR SEDIMENTATION IMPACTS THAT MAY OCCUR BELOW STORMWATER OUTFALLS OR OFFSITE AS A RESULT OF CONSTRUCTION OF THE PROJECT.

CONSTRUCTION SAFETY AND SECURITY NOTES:

1. ALL CONSTRUCTION SHALL ADHERE TO OSHA STANDARDS AND REGULATIONS.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PURCHASE AND INSTALLATION OF HIGH VISIBILITY FENCING TO BE PLACED ALONG THE PROJECT PERIMETER. WARNING SIGNS SHALL ALSO BE PROVIDED.
3. THE CONTRACTOR SHALL PROVIDE CONSTRUCTION WARNING SIGNS AND TRAFFIC CONTROL AS REQUIRED BY THE NJ DEPARTMENT OF TRANSPORTATION WITH REGARD TO ACCESS OF CONSTRUCTION VEHICLES AND TRUCKS UTILIZING MUNICIPAL OR STATE ROADWAYS.

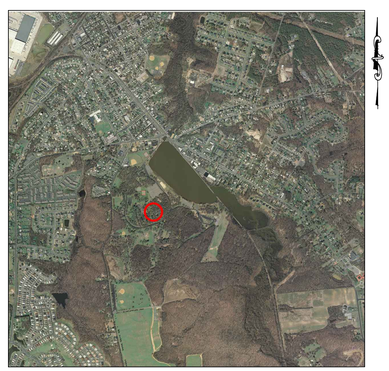
PREPARED FOR:

NEW JERSEY WATER SUPPLY AUTHORITY
ON BEHALF OF
THE MANALAPAN BROOK WATERSHED RESTORATION AND PROTECTION PLAN PROJECT COMMITTEE
WATERSHED PROTECTION PROGRAM
74 EAST MAIN STREET
SOMERVILLE, NJ 08876-2312
P. 908.685.0315

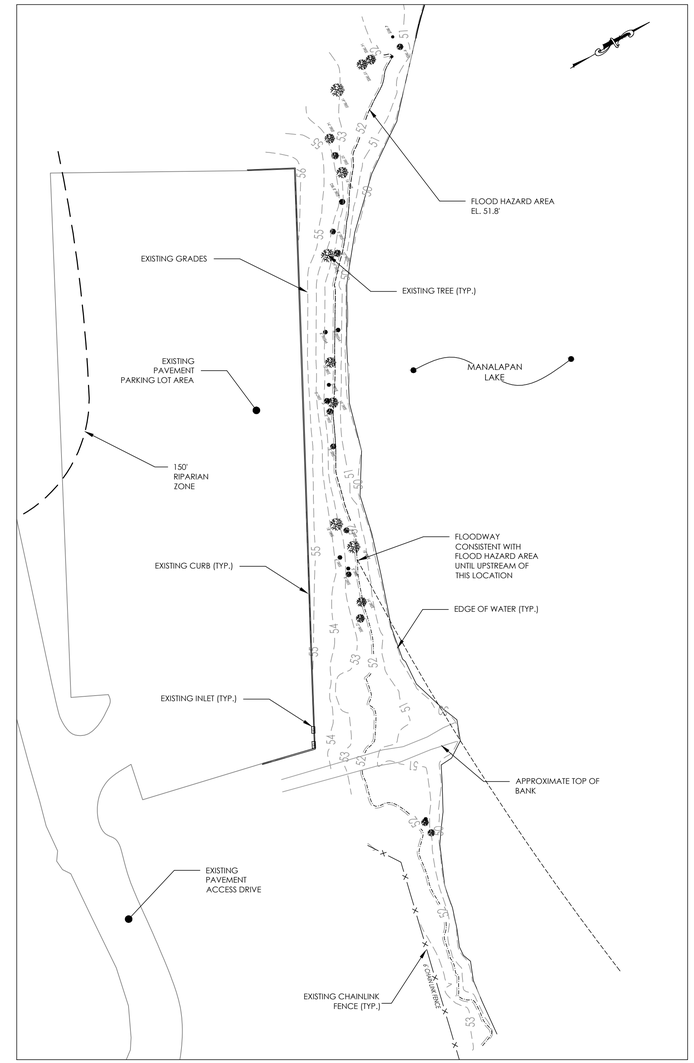
SHEET INDEX:

SHEET 1 - TITLE SHEET AND EXISTING CONDITIONS
SHEET 2 - PROPOSED CONDITIONS AND PLANTING PLAN
SHEET 3 - EROSION &SEDIMENT CONTROL PLAN AND DETAILS AND CONSTRUCTION DETAILS
SHEET 4 - EROSION AND SEDIMENT CONTROL NOTES

A PROJECT VICINITY
SCALE: 1" = 2000'
USGS QUADRANGLE
7.5 MINUTE SERIES
JAMESBURG, NEW JERSEY QUADRANGLE



B ORTHOPHOTOGRAPHY
SITE LOCATION
1"=2000'



GRAPHIC SCALE
0 10 20 30 40 80 120 160 FEET
SCALE: 1" = 40'

C EXISTING CONDITIONS

CALL BEFORE YOU DIG!
NEW JERSEY LAW REQUIRES
3 WORKING DAYS NOTICE FOR CONSTRUCTION PHASE AND 10 WORKING DAYS IN DESIGN STAGE -- STOP CALL
NEW JERSEY ONE CALL SYSTEM, INC.
REFERENCE NEW JERSEY TITLE 48, CHPT. 2, ARTICLE 9
1-800-272-1000

PROJECT NOTES

GENERAL NOTES:

1. THE CONDITIONS SHOWN ON THIS PLAN ARE BASED ON TOPOGRAPHIC SURVEY COMPLETED BY B&B HI-TECH, WEST BERLIN, NJ, MARCH 9, 2010.
2. THE HORIZONTAL DATUM IS NORTH AMERICAN DATUM 1983 (NAD83) NEW JERSEY STATE PLANE (FIPS 2900), UNITS OF FEET.
3. THE VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM 1988 (NAVD88), UNITS OF FEET.
4. NO WETLANDS DELINEATION WAS COMPLETED AS PART OF THIS TOPOGRAPHIC SURVEY, PLEASE SEE PERMITTING GUIDANCE DOCUMENT.

DATE	DESCRIPTION

REVISIONS

STATE OF NEW JERSEY CERTIFICATE OF AUTH. NO.: 24GA27976800

KEITHE J. MERL
Professional Engineer
NJ Lic. No. GE44839

DATE

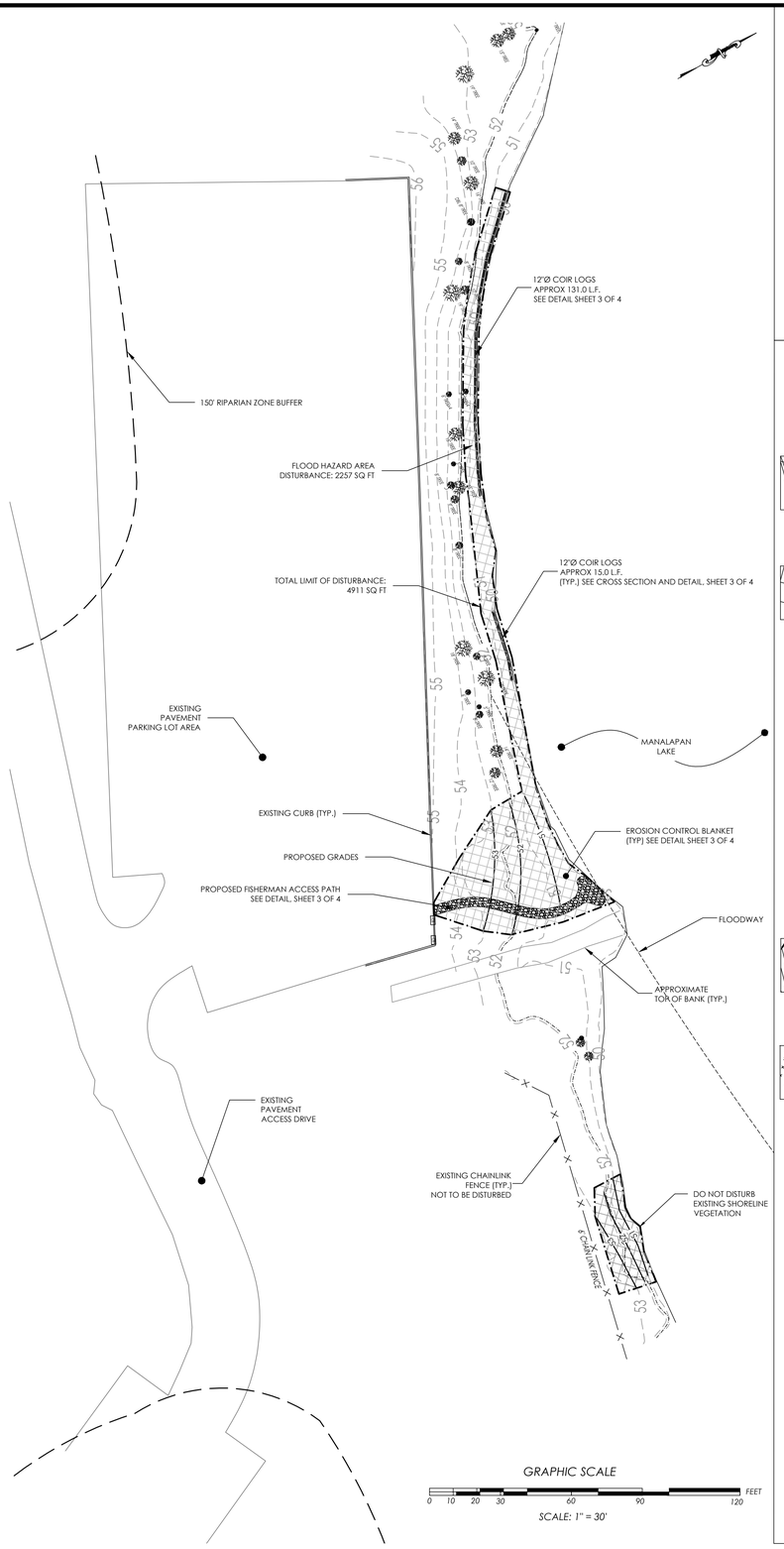
PRINCETON HYDRO, LLC
SCIENTISTS AND ENGINEERS
120 EAST UWCHLAN AVENUE
SUITE 204
EXTON, PENNSYLVANIA 19341
PHONE. 610.524.4220
FAX. 610.514.9434
WWW.PRINCETONHYDRO.COM

PROJECT NAME/LOCATION:
MANALAPAN LAKE
SHORELINE STABILIZATION
AT STATION #37, THOMPSON PARK
MIDDLESEX COUNTY, NEW JERSEY

DRAWING NAME:
TITLE SHEET
AND EXISTING CONDITIONS

DATE:	02/28/2011
PROJECT NO.:	0457.008
SCALE:	AS SHOWN
DRAWN BY:	JEO
CHECKED BY:	KJM

SHEET NO.
1 OF 4



A PROPOSED CONDITIONS

LEGEND

- EXISTING CONTOUR
- PROPOSED CONTOUR
- EROSION CONTROL BLANKET
- EXISTING TREE
- EDGE OF WATER
- LIMIT OF DISTURBANCE
- 150 FT RIPARIAN ZONE BUFFER
- EDGE OF PAVEMENT
- FENCE
- COIR LOG

PLANT LIST AND KEY

AQUATIC PLUGS 1,160 SQUARE FEET

TO BE PLANTED IN WATER IN GROUPS OF 5 TO 10 PLUGS, WITHIN THREE (3) FEET OF SHORELINE. EACH PLUG SPACED THREE (3) FEET ON CENTER

BOTANICAL NAME	SPECIES NAME	PLANTING TYPE:	INDICATOR STATUS:	QUANTITY:
HIBUSCUS MOSCHEUTOS	SWAMP ROSE MALLOW	PEAT POT/PLUG	OBL	50
SCIRPUS ATROVENS	GREEN BULLRUSH	PEAT POT/PLUG	OBL	50
SPARGANUM AMERICANUM	LESSER BUR REED	PEAT POT/PLUG	OBL	50

SHORELINE SHRUBS AND TREES 2,794 SQUARE FEET

SPACED SIX (6) FEET ON CENTER STAGGERED IRREGULARLY THROUGH AREA.

BOTANICAL NAME	SPECIES NAME	PLANTING TYPE:	INDICATOR STATUS:	QUANTITY:
BETULA NIGRA	RIVER BIRCH	2 GALLON	FACW	10
CORNUS AMOMUM	SILKY DOGWOOD	1 GALLON	FACW	20
LINDERA BENZOIN	SPICEBUSH	1 GALLON	FACW-	10
LIQUIDAMBAR STYRACIFLUA	SWEETGUM	2 GALLON	FAC	10
PHYSOCARPUS OPULIFOLIUS	COMMON NINEBARK	1 GALLON	FACW-	10
VIBURNUM DENTATUM	ARROWWOOD VIBURNUM	1 GALLON	FAC	20

SHORELINE SEED 2,100 SQUARE FEET

TO BE SOWN OVER ALL DISTURBED AREAS WITHIN ONE FOOT ELEVATION FROM WATER'S EDGE.

BOTANICAL NAME	SPECIES NAME	APPROXIMATE RATE (LBS PURE LIVE SEED/ACRE)	INDICATOR STATUS:
ELYMUS RIPARIUS	RIVERBANK WILD RYE	0.5	FACW
HELENIUM AUTUMNALE	HELEN'S FLOWER	2	FACW+
JUNCUS EFFUSUS	SOFT RUSH	1	FACW+
PANICUM DICHOTOMIFLORUM	SMOOTH PANIC GRASS	5	FACW-
POLYGONUM PENSYLVANICUM	PENNSYLVANIA SMARTWEED	2	FACW
SCIRPUS ATROVIRENS	GREEN BULRUSH	2	OBL
VERBENA HASTATA	BLUE VERVAIN	2	FACW+
PANICUM CLANDESTINUM	DEER TONGUE	2	FAC+
PANICUM VIRGATUM	PANICGRASS	6	FAC
SCHIZACHYRIUM SCOPARIUM	LITTLE BLUESTEM	6	FACU-

UPLAND SHRUBS AND TREES 1,070 SQUARE FEET

SPACED EIGHT (8) FEET ON CENTER STAGGERED IRREGULARLY THROUGH AREA.

BOTANICAL NAME	SPECIES NAME	PLANTING TYPE:	INDICATOR STATUS:	QUANTITY:
SASSAFRAS ALBIDUM	SASSAFRAS	2 GALLON	FACU-	5
CORNUS RACEMOSA	GRAY DOGWOOD	1 GALLON	UPL	10
MYRICA PENSYLVANICA	NORTHERN BAYBERRY	1 GALLON	FAC	5

UPLAND MEADOW SEED 1,710 SQUARE FEET

TO BE SOWN OVER ALL DISTURBED AREAS ABOVE ONE FOOT ELEVATION FROM WATER'S EDGE.

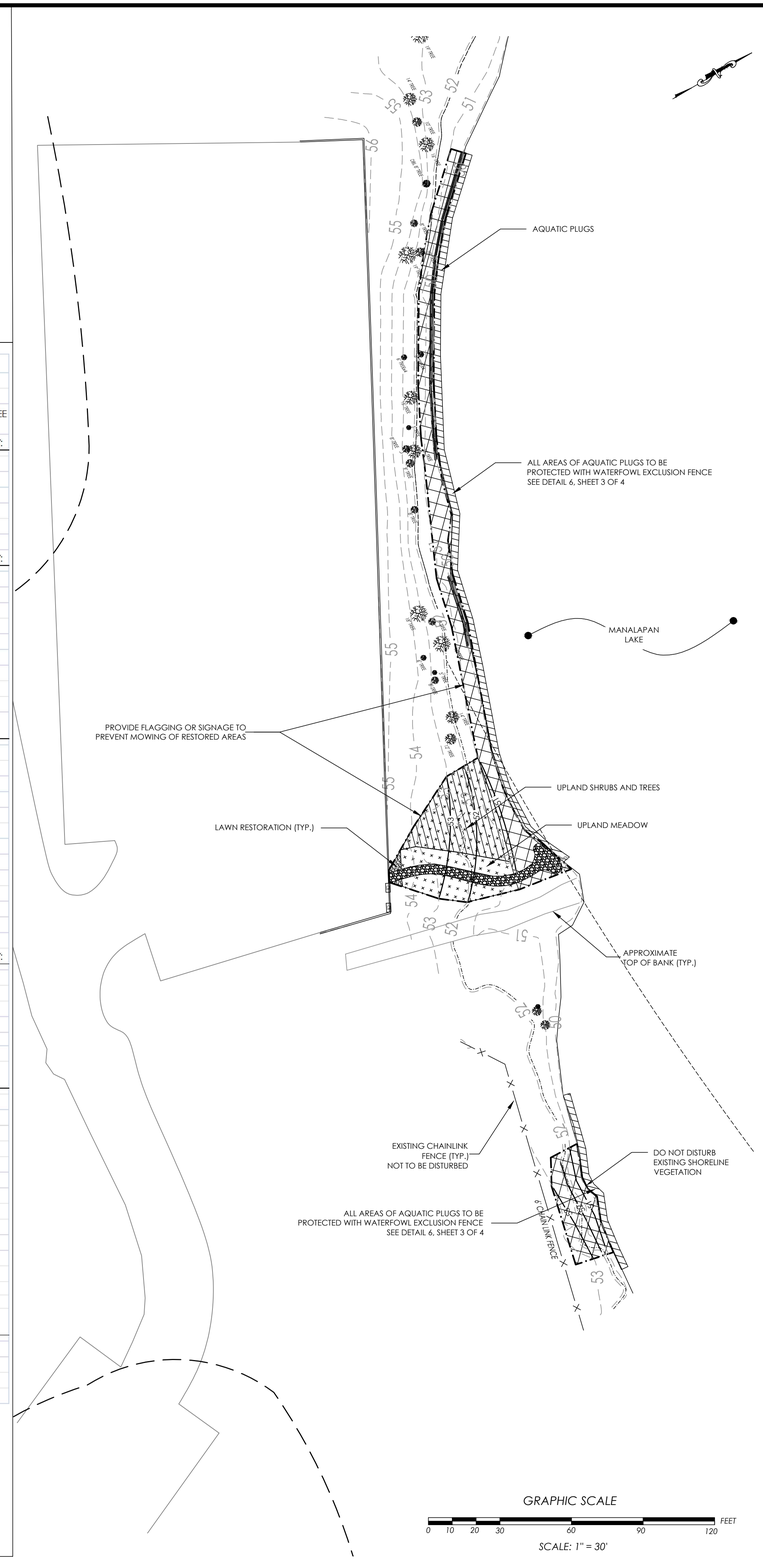
BOTANICAL NAME	SPECIES NAME	APPROXIMATE RATE (LBS PURE LIVE SEED/ACRE)	INDICATOR STATUS:
AGROSTIS PERENNANS	AUTUMN BENTGRASS	3/4	FACU
ASCLEPIAS SYRIACA	COMMON MILKWEED	1/4	NI
CHAMAECRISTA FASCICULATA	PARTIDGE PEA	1	FACU
CHASMANTHIUM LATIFOLIUM	RIVER OATS	3/4	FACU
COREOPSIS LANCEOLATA	LANCE LEAVED COREOPSIS	10	FACU
ECHINACEA PURPUREA	PURPLE CONEFLOWER	12	-
HELIOPSIS HELIANTHOIDES	OX EYE SUNFLOWER	1/2	-
LOLIUM MULTIFLORUM	ANNUAL RYE	15	-
MONARDA FISTULOSA	WILD BERGAMOT	1/4	UPL
RUDBECKIA TRILOBA	BROWN EYED SUSAN	1/4	FACU
SCHIZACHRYRIUM SCOPARIUM	LITTLE BLUE STEM	6	FACU-
SENNA HEBECARPA	WILD SENNA	10	FAC

LAWN SEED 32 SQUARE FEET

BOTANICAL NAME	SPECIES NAME	APPROXIMATE RATE (LBS PURE LIVE SEED/ACRE)
FESTUCA BREVIPILA	HARD FESCUE	120
LOLIUM PERENNE	PERENNIAL RYEGRASS	30
POA PRATENSIS	KENTUCKY BLUEGRASS	40

QUANTITIES

STONE FOR FISHERMAN ACCESS PATH	4.4 CY
EROSION CONTROL BLANKET	473 SY
COIR LOGS	146 LF
TOP SOIL	30 CY



B PLANTING PLAN

CALL BEFORE YOU DIG!
NEW JERSEY LAW REQUIRES
3 WORKING DAYS NOTICE FOR
CONSTRUCTION PHASE AND 10 WORKING
DAYS IN DESIGN STAGE – STOP CALL
NEW JERSEY ONE CALL SYSTEM, INC.
REFERENCE NEW JERSEY TITLE 48, CHPT. 2, ARTICLE 9
1-800-272-1000

PROJECT NOTES

GENERAL NOTES:

1. THE CONDITIONS SHOWN ON THIS PLAN ARE BASED ON TOPOGRAPHIC SURVEY COMPLETED BY B&B HI-TECH, WEST BERLIN, N.J. MARCH 9, 2010.
2. THE HORIZONTAL DATUM IS NORTH AMERICAN DATUM 1983 (NAD83) NEW JERSEY STATE PLANE (FIPS 2900), UNITS OF FEET.
3. THE VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM 1988 (NAVD88), UNITS OF FEET.
4. NO WETLANDS DELINEATION WAS COMPLETED AS PART OF THIS TOPOGRAPHIC SURVEY. PLEASE SEE PERMITTING GUIDANCE DOCUMENT.

DATE	DESCRIPTION

REVISIONS

STATE OF NEW JERSEY CERTIFICATE OF AUTH. NO.: 24GA27976800

KEITHE J. MERL
Professional Engineer
NJ Lic. No. GE44839

DATE

PRINCETON HYDRO, LLC

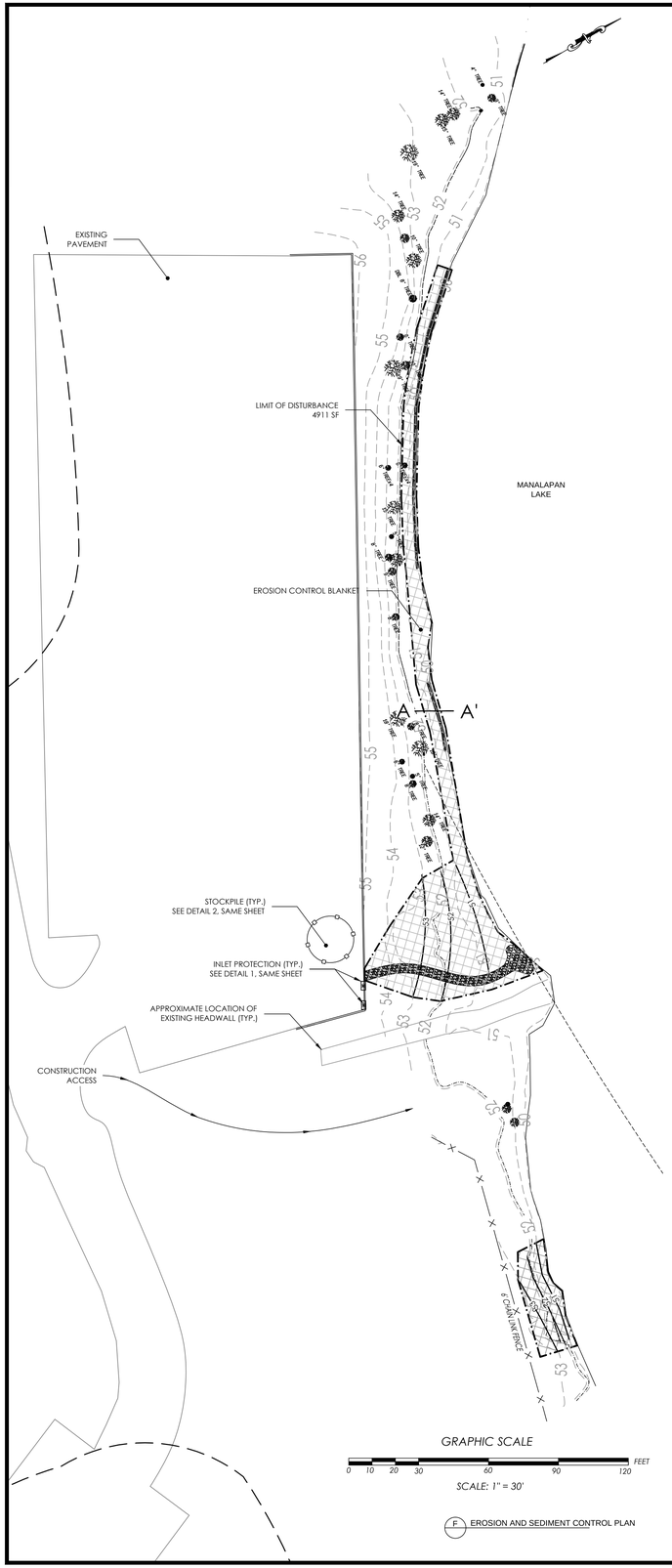
SCIENTISTS AND ENGINEERS
120 EAST UWCHLAN AVENUE
SUITE 204
EXTON, PENNSYLVANIA 19341
PHONE. 610.524.4220
FAX. 610.524.9434
WWW.PRINCETONHYDRO.COM

PROJECT NAME/LOCATION:
MANALAPAN LAKE
SHORELINE STABILIZATION
AT STATION #37, THOMPSON PARK
MIDDLESEX COUNTY, NEW JERSEY

DRAWING NAME:
PROPOSED CONDITIONS
AND PLANTING PLAN

DATE:	02/28/2011
PROJECT NO.:	0457.008
SCALE:	AS SHOWN
DRAWN BY:	JEO
CHECKED BY:	CHE/KJM

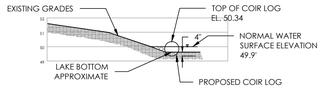
SHEET NO. 2 OF 4



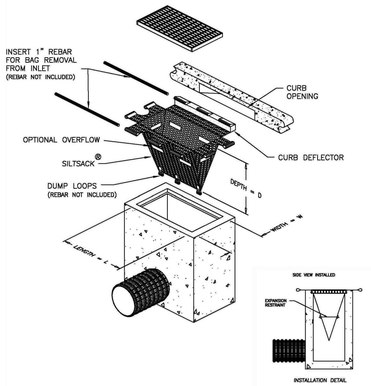
F EROSION AND SEDIMENT CONTROL PLAN

CONSTRUCTION SEQUENCE

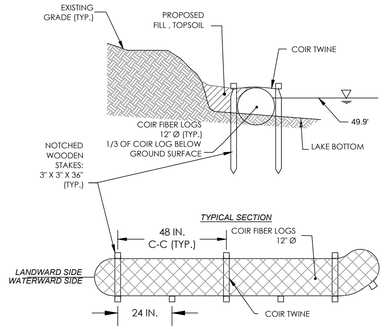
1.	GRADE AS SHOWN ON PLAN	0.5 DAY
2.	INSTALL ACCESS PATH	0.5 DAY
3.	INSTALL COIR LOGS	1 DAY
4.	COMPLETE GRADING	1 DAY
5.	INSTALL EROSION CONTROL BLANKET	1 DAY
6.	SEED AND PLANT	2 DAY
		TOTAL: 6 DAYS



7 CROSS SECTION A-A'



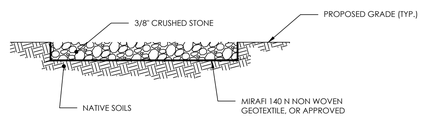
1 INLET SEDIMENT CONTROL DEVICE
NOT TO SCALE



NOTE:

1. COIR LOGS ARE PLANTER LOGS PREPARED BY ROLANKA INC. OR APPROVED EQUAL. INSTALL ACCORDING TO MANUFACTURER'S INSTRUCTIONS.
2. COIR LOGS SHALL BE PLACED APPROXIMATELY 1/3 OF THE DIAMETER OF THE COIR LOG BELOW GROUND SURFACE
3. AREA BEHIND COIR LOG TO BE BACKFILLED WITH TOPSOIL.
4. PLANTINGS TO BE PLUGGED IN AN ALTERNATING PATTERN ALONG THE TOP OF THE COIR LOG.
5. DRIVE IN TIE-DOWN STAKES SO THAT TWINE IS SECURED AGAINST THE TOP OF THE COIR LOG.

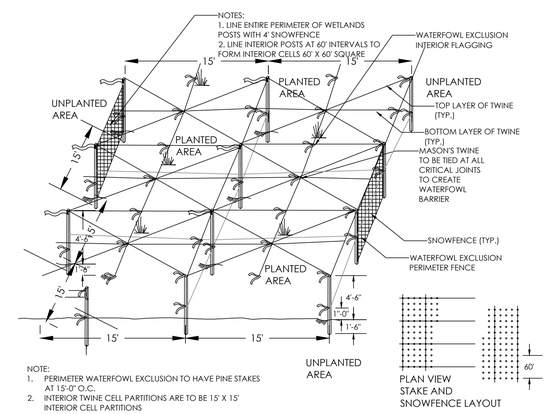
3 COIR LOG INSTALLATION DETAIL
NOT TO SCALE



NOTES:

1. ACCESS PATH IS 15 FOOT IN WIDTH AT WATERS EDGE AND CONTINUES AT 4 FOOT WIDTH TO TOP OF SLOPE
2. 4 INCHES OF CLEAN 3/8 INCH CRUSHED STONE TO BE PLACED.
3. TOP OF STONE TO MATCH EXISTING GRADE

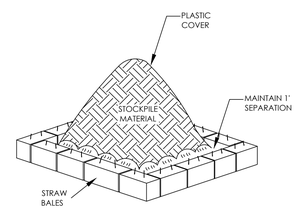
5 ACCESS PATH
NOT TO SCALE



NOTE:

1. PERIMETER WATERFOWL EXCLUSION TO HAVE PINE STAKES AT 15'-0" O.C.
2. INTERIOR TWINE CELL PARTITIONS ARE TO BE 15' X 15' INTERIOR CELL PARTITIONS
3. INTERIOR SNOWFENCE CELL PARTITIONS ARE TO BE 60' X 60' INTERIOR CELL PARTITIONS

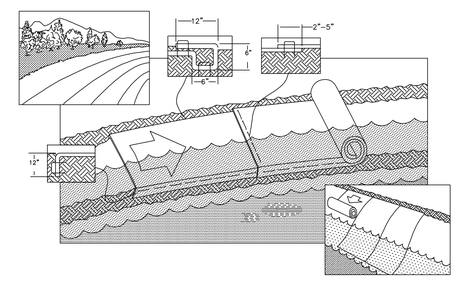
6 TYPICAL WATERFOWL EXCLUSION
NOT TO SCALE



NOTE:

1. UPON PRIOR APPROVAL FROM ENGINEER: SILT FENCING MAY BE SUBSTITUTED FOR STRAW BALES, AND TEMPORARY SEEDING OF STOCKPILES MAY BE SUBSTITUTED FOR PLASTIC COVERING.

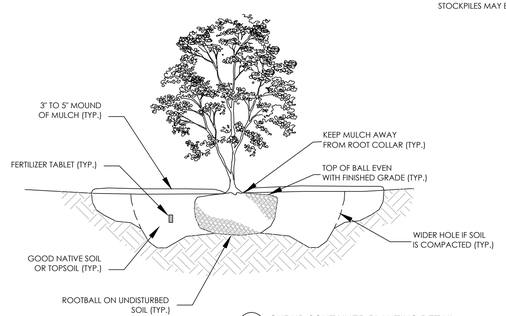
2 STOCKPILE CONTROL DETAIL
NOT TO SCALE



NOTES:

1. EROSION CONTROL BLANKET SHALL BE COIR MAT 900 OR APPROVED EQUIVALENT.
2. STAPLES OR STAKES SHALL BE 6" MINIMUM HEIGHT UNLESS OTHERWISE REQUIRED.
3. PREPARE SOIL (SEED) BEFORE INSTALLING EROSION CONTROL BLANKETS (ECB'S) AS PER SEEDING SPECIFICATIONS IDENTIFIED BELOW INCLUDING ANY NECESSARY APPLICATION OF LIME, FERTILIZER, STRAW AND SEED.
4. BEGIN AT THE TOP OF THE AREA BY ANCHORING THE BLANKET IN A 6" DEEP BY 6" WIDE TRENCH WITH APPROXIMATELY 12" OF EXTENDED BEYOND THE UP-SLOPE PORTION OF THE TRENCH. ANCHOR THE BLANKET WITH A ROW OF STAPLES/STAKES APPROXIMATELY 12" APART IN THE BOTTOM OF THE TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING. APPLY SEED TO COMPACTED SOIL AND FOLD REMAINING 12" PORTION OF ECB BACK OVER SEED AND COMPACTED SOIL. SECURE OVER COMPACTED SOIL WITH A ROW OF STAPLES/STAKES SPACED APPROXIMATELY 12" APART ACROSS THE WIDTH OF THE BLANKET.
5. ROLL ECB'S EITHER (A) DOWN THE SHORELINE FOR LONG BANKS, (TO BOTTOM) OR (B) HORIZONTALLY ACROSS THE SHORELINE SLOPE. ECB'S WILL UNROLL WITH APPROPRIATE SIDE AGAINST THE SOIL SURFACE. ALL ECB'S MUST BE SECURELY FASTENED TO SOIL SURFACE BY PLACING STAPLES/STAKES IN APPROPRIATE LOCATIONS AS SHOWN IN THE STAPLE PATTERN GUIDE.
6. THE EDGES OF ALL HORIZONTAL AND VERTICAL SEAMS MUST BE STAPLED WITH APPROXIMATELY 2"-5" OVERLAP. SEAM OVERLAP SHOULD BE SHINGLED ACCORDING TO PREDOMINANT EROSIVE ACTION.
7. IN LOOSE SOIL CONDITIONS, THE USE OF STAPLE OR STAKE LENGTHS GREATER THAN 6" MAY BE NECESSARY TO PROPERLY ANCHOR THE ECB'S

4 EROSION CONTROL BLANKET
NOT TO SCALE



8 SHRUB CONTAINER PLANTING DETAIL
NOT TO SCALE

CALL BEFORE YOU DIG!
NEW JERSEY LAW REQUIRES
3 WORKING DAYS NOTICE FOR CONSTRUCTION PHASE AND 10 WORKING DAYS IN DESIGN STAGE -- STOP CALL
NEW JERSEY ONE CALL SYSTEM, INC.
REFERENCE NEW JERSEY TITLE 48, CHPT. 2, ARTICLE 9
1-800-272-1000

PROJECT NOTES

GENERAL NOTES:

1. THE CONDITIONS SHOWN ON THIS PLAN ARE BASED ON TOPOGRAPHIC SURVEY COMPLETED BY B&B HI-TECH, WEST BERLIN, NJ, MARCH 9, 2010.
2. THE HORIZONTAL DATUM IS NORTH AMERICAN DATUM 1983 (NAD83) NEW JERSEY STATE PLANE (FIPS 2900), UNITS OF FEET.
3. THE VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM 1988 (NAVD88), UNITS OF FEET.
4. NO WETLANDS DELINEATION WAS COMPLETED AS PART OF THIS TOPOGRAPHIC SURVEY. PLEASE SEE PERMITTING GUIDANCE DOCUMENT.

DATE	DESCRIPTION

REVISIONS

STATE OF NEW JERSEY CERTIFICATE OF AUTH. NO.: 24GA27976800

KEITHE J. MERL
Professional Engineer
NJ Lic. No. GE44839

DATE

PRINCETON HYDRO, LLC
SCIENTISTS AND ENGINEERS
120 EAST UWCHLAN AVENUE
SUITE 204
EXTON, PENNSYLVANIA 19341
PHONE. 610.524.4220
FAX. 610.524.9434
WWW.PRINCETONHYDRO.COM

PROJECT NAME/LOCATION:
MANALAPAN LAKE
SHORELINE STABILIZATION
AT STATION #37, THOMPSON PARK
MIDDLESEX COUNTY, NEW JERSEY

DRAWING NAME:
EROSION AND SEDIMENT CONTROL PLAN AND DETAILS AND CONSTRUCTION DETAILS

DATE:	02/28/11
PROJECT NO.:	0457.008
SCALE:	AS SHOWN
DRAWN BY:	JEO
CHECKED BY:	KJM

SHEET NO.
3 OF 4

STANDARD FOR PERMANENT VEGETATIVE COVER FOR SOIL STABILIZATION

DEFINITION:
ESTABLISHMENT OF PERMANENT VEGETATIVE COVER ON EXPOSED SOILS WHERE PERENNIAL VEGETATION IS NEEDED FOR LONG TERM PROTECTION.

PURPOSE:
TO PERMANENTLY STABILIZE THE SOIL, ASSURING CONSERVATION OF SOIL AND WATER, AND TO ENHANCE THE ENVIRONMENT.

WATER QUALITY ENHANCEMENT:
SLOWS THE OVERLAND MOVEMENT OF STORMWATER RUNOFF, INCREASES INFILTRATION AND RETAINS SOIL AND NUTRIENTS ON SITE, PROTECTING STREAMS OR OTHER STORMWATER CONVEYANCES.

WHERE APPLICABLE:
ON EXPOSED SOILS

METHODS AND MATERIALS:

1. SITE PREPARATION

A. GRADE AS NEEDED AND FEASIBLE TO PERMIT THE USE OF CONVENTIONAL EQUIPMENT FOR SEEDBED PREPARATION, SEEDING, MULCH APPLICATION, AND MULCH ANCHORING. ALL GRADING SHOULD BE DONE IN ACCORDANCE WITH STANDARD FOR LAND GRADING ("STANDARDS FOR SOIL EROSION AND SEDIMENT CONTROL IN NEW JERSEY", THE NEW JERSEY STATE SOIL CONSERVATION COMMITTEE, JULY, 1999, PAGE 19-1.)

B. IMMEDIATELY PRIOR TO TOPSOILING, THE SURFACE SHOULD BE SCARIFIED 6 TO 12 INCHES. THIS WILL HELP ENSURE A GOOD BOND BETWEEN THE TOPSOIL AND SUBSOIL.

C. EMPLOY NEEDED EROSION CONTROL PRACTICES SUCH AS DIVERSIONS, GRADE STABILIZATION STRUCTURES, CHANNEL STABILIZATION MEASURES, SEDIMENTATION BASINS, AND WATERWAYS. SEE STANDARDS 11 THROUGH 42, "STANDARDS FOR SOIL EROSION AND SEDIMENT CONTROL IN NEW JERSEY", THE NEW JERSEY STATE SOIL CONSERVATION COMMITTEE, JULY 1999.

2. SEEDBED PREPARATION

A. APPLY GROUND LIMESTONE AND FERTILIZER ACCORDING TO SOIL TEST RECOMMENDATIONS SUCH AS OFFERED BY RUTGERS CO-OPERATIVE EXTENSION. SOIL SAMPLE MAILERS ARE AVAILABLE FROM THE LOCAL RUTGERS COOPERATIVE EXTENSION OFFICES. FERTILIZER SHALL BE APPLIED AT THE RATE OF 500 POUNDS PER ACRE OR 11 POUNDS PER 1,000 SQUARE FEET OF 10-20-10 OR EQUIVALENT WITH 50% WATER INSOLUBLE NITROGEN UNLESS A SOIL TEST INDICATES OTHERWISE. APPLY LIMESTONE IN ACCORDANCE WITH TABLE 4-1 AND THE RESULTS OF SOIL TESTING. CALCIUM CARBONATE IS THE EQUIVALENT AND STANDARD FOR MEASURING THE ABILITY OF LIMING MATERIALS TO NEUTRALIZE SOIL ACIDITY AND SUPPLY CALCIUM AND MAGNESIUM TO GRASSES AND LEGUMES. TABLE 4-1 IS A GENERAL GUIDELINE FOR LIMESTONE APPLICATION RATES.

B. WORK LIME AND FERTILIZER INTO THE SOIL AS NEARLY AS PRACTICAL TO A DEPTH OF 4 INCHES WITH A DISC, SPRINGTOOTH HARROW, OR OTHER SUITABLE EQUIPMENT. THE FINAL HARROWING OR DISCING OPERATION SHOULD BE ON THE GENERAL CONTOUR. CONTINUE TILLAGE UNTIL A REASONABLE UNIFORM SEEDBED IS PREPARED.

C. IMMEDIATELY PRIOR TO TOPSOILING, THE SURFACE SHOULD BE SCARIFIED 6 TO 12 INCHES WHERE THERE HAS BEEN SOIL COMPACTION. THIS WILL HELP ENSURE A GOOD BOND BETWEEN THE TOPSOIL AND SUBSOIL.

D. A UNIFORM APPLICATION TO A DEPTH OF 5 INCHES (UNSETTLED) IS RECOMMENDED. SOILS WITH A Ph OF 4.0 OR SHALL BE COVERED WITH A MINIMUM DEPTH OF 12 INCHES OF SOIL HAVING A pH OF 5.0 OR MORE, IN ACCORDANCE WITH THE STANDARD FOR MANAGEMENT OF HIGH ACID PRODUCING SOIL, ("STANDARDS FOR SOIL EROSION AND SEDIMENT CONTROL IN NEW JERSEY", THE NEW JERSEY STATE SOIL CONSERVATION COMMITTEE, JULY 1999, PAGE 1-1.)

3. SEEDING

A. SEE SHEET 3 OF 4 FOR PERMANENT SEED MIXTURE

1. SEEDING RATES SPECIFIED ARE REQUIRED WHEN A REPORT OF COMPLIANCE IS REQUESTED PRIOR TO ACTUAL ESTABLISHMENT OF PERMANENT VEGETATION. UP TO 50% REDUCTION IN RATES MAY BE USED WHEN PERMANENT VEGETATION IS ESTABLISHED PRIOR TO A REPORT OF COMPLIANCE INSPECTION. THESE RATES APPLY TO ALL METHODS OF SEEDING. ESTABLISHING PERMANENT VEGETATION MEANS 80% VEGETATIVE COVERAGE WITH THE SPECIFIED SEED MIXTURE FOR THE SEEDBED AREA AND MOWED ONCE.

B. **CONVENTIONAL SEEDING** IS PERFORMED BY APPLYING SEED UNIFORMLY BY HAND, CYCLONE (CENTRIFUGAL) SEEDER, DROP SEEDER, DRILL OR CULTIPACKER. EXCEPT FOR DRILLED, HYDROSEEDED OR CULTIPACKED SEEDINGS, SEED SHALL BE INCORPORATED INTO THE SOIL WITHIN 24 HOURS OF SEEDBED PREPARATION TO A DEPTH OF 1/4 TO 1/2 INCH, BY RAKING OR DRAGGING. DEPTH OF SEED PLACEMENT MAY BE 1/4 INCH DEEPER ON COARSE TEXTURED SOIL.

C. **HYDROSEEDING** IS A BROADCAST SEEDING METHOD USUALLY INVOLVING A TRUCK OR TRAILER MOUNTED TANK, WITH AN AGITATION SYSTEM AND HYDRAULIC PUMP FOR MIXING SEED, WATER AND FERTILIZER AND SPRAYING THE MIX ONTO THE PREPARED SEEDBED. MULCH **SHALL NOT** BE INCLUDED IN THE TANK WITH SEED. SHORT FIBERED MULCH MAY BE APPLIED WITH A HYDROSEEDER FOLLOWING SEEDING. (ALSO SEE SECTION IV MULCHING BELOW) HYDROSEEDING IS **NOT PREFERRED SEEDING METHOD** BECAUSE SEED AND FERTILIZER ARE APPLIED TO THE SURFACE AND INCORPORATED INTO THE SOIL. POOR SEED TO SOIL CONTACT OCCURS REDUCING SEED GERMINATION AND GROWTH. HYDROSEEDING MAY BE USED FOR AREAS TO STEEP FOR CONVENTIONAL EQUIPMENT TO TRAVERSE OR TOO OBSTRUCTED WITH ROCKS, STUMPS, ETC.

D. AFTER SEEDING, FIRMING THE SOIL WITH A CORRUGATED ROLLER WILL ASSURE GOOD SEED TO SOIL CONTACT, RESTORE CAPILLARITY, AND IMPROVE SEEDLING EMERGENCE. **THIS IS THE PREFERRED METHOD**. WHEN PERFORMED ON THE CONTOUR, SHEET EROSION WILL BE MINIMIZED AND WATER CONSERVATION ON SITE WILL BE MAXIMIZED.

4. MULCHING

MULCHING IS REQUIRED ON ALL SEEDING. MULCH WILL INSURE AGAINST EROSION BEFORE GRASS IS ESTABLISHED AND WILL PROMOTE FASTER AND EARLIER ESTABLISHMENT. THE EXISTENCE OF VEGETATION SUFFICIENT TO CONTROL SOIL EROSION SHALL BE DEEMED IN COMPLIANCE WITH THIS MULCHING REQUIREMENT.

A. **STRAW OR HAY.** UNROTTED SMALL GRAIN STRAW, HAY FREE OF SEEDS, OR SALT HAY TO BE APPLIED AT THE RATE OF 1-1/2 TO 2 TONS PER ACRE (70 TO 90 POUNDS PER 1,000 SQUARE FEET), EXCEPT THAT WHERE A CRIMER IS USED INSTEAD OF LIQUID MULCH-BINDER (TACKIFYING OR ADHESIVE AGENT), THE RATE OF APPLICATION IS 3 TONS PER ACRE. MULCH CHOPPER-BLOWERS **MUST NOT** GRIND THE MULCH. HAY MULCH IS NOT RECOMMENDED FOR ESTABLISHING FINE TURF OR LAWNS DUE TO THE PRESENCE OF WEED SEED.
APPLICATION. SPREAD MULCH UNIFORMLY BY HAND OR MECHANICALLY SO THAT APPROXIMATELY 85% OF THE SOIL SURFACE WILL BE COVERED. FOR UNIFORM DISTRIBUTION OF HAND-SPREAD MULCH, DIVIDE AREA INTO APPROXIMATELY 1,000 SQUARE FEET SECTIONS AND DISTRIBUTE 70 TO 90 POUNDS WITHIN EACH SECTION.
ANCHORING. ANCHORING SHALL BE ACCOMPLISHED IMMEDIATELY AFTER PLACEMENT TO MINIMIZE LOSS BY WIND AND WATER. THIS MAY BE DONE BY ONE OF THE FOLLOWING METHODS, DEPENDING UPON THE SIZE OF THE AREA, STEEPNESS OF SLOPES, AND COSTS.

1. PEG AND TWINE. DRIVE 8 TO 10 INCH WOODEN PEGS TO WITHIN 2 TO 3 INCHES OF THE SOIL SURFACE EVERY 4 FEET IN ALL DIRECTIONS. STAKES MAY BE DRIVEN BEFORE OR AFTER APPLYING MULCH. SECURE MULCH TO SOIL SURFACE BY STRETCHING TWINE BETWEEN PEGS IN A CRISS-CROSS AND SQUARE PATTERN. SECURE TWINE AROUND EACH PEG WITH TWO OR MORE TURNS.

2. MULCH NETTINGS. STAPLE PAPER, JUTE, COTTON, OR PLASTIC NETTINGS TO THE SOIL SURFACE. USE A DEGRADABLE NETTING IN AREAS TO BE MOVED.

3. CRIMPER (MULCH ANCHORING COULTER TOOL, PREFERRED METHOD). A TRACTOR-DRAWN IMPLEMENT, SOMEWHAT LIKE A DISC HARROW, ESPECIALLY DESIGNED TO PUSH OR CUT SOME OF THE BROADCAST LON FIBER MULCH 3 TO 4 INCHES INTO THE SOIL SO AS TO ANCHOR IT AND LEAVE PART STANDING UPRIGHT. THIS TECHNIQUE IS LIMITED TO AREAS TRAVERSABLE BY A TRACTOR, WHICH MUST OPERATE ON THE CONTOUR OF SLOPES. STRAW MULCH RATE MUST BE 3 TONS PER ACRE. NO ADHESIVE AGENT IS REQUIRED.

4. LIQUID MULCH BINDERS. MAY BE USED TO ANCHOR SALT HAY, HAY AND STRAW MULCH.
a. APPLICATIONS SHOULD BE HEAVIER AT EDGES WHERE WIND MAY CATCH THE MULCH, IN VALLEYS, AND AT CRESTS OF BANKS. THE REMAINDER OF THE AREA SHOULD BE UNIFORM IN APPEARANCE.
b. USE ONE OF THE FOLLOWING:
(1) ORGANIC AND VEGETABLE BASED BINDERS. NATURALLY OCCURRING, POWDER BASED, HYDROPHILIC MATERIALS WHEN MIXED WITH WATER FORMULATES A GEL AND WHEN APPLIED TO MULCH UNDER SATISFACTORY CURING CONDITIONS WILL FORM MEMBRANED NETWORKS OF INSOLUBLE POLYMERS. THE VEGETABLE GEL SHALL BE PHYSIOLOGICALLY HARMLESS AND NOT RESULT IN A PHYTOTOXIC EFFECT OR IMPEDE GROWTH OF TURFGRASS. USE AT A RATE AND WEATHER CONDITIONS AS RECOMMENDED BY THE MANUFACTURER TO ANCHOR MULCH MATERIALS. **MANY NEW PRODUCTS AREA AVAILABLE, SOME OF WHICH MAY NEED FURTHER EVALUATION FOR USE IN THIS STATE.**

(2) SYNTHETIC BINDERS. HIGH POLYMER SYNTHETIC EMULSION, MISCIBLE WITH WATER WHEN DILUTED AND FOLLOWING APPLICATION TO MULCH, DRYING AND CURING SHALL NO LONGER BE SOLUBLE OR DISPERSIBLE IN WATER. IT SHALL BE APPLIED AT RATES RECOMMENDED BY THE MANUFACTURER AND REMAIN TACKY UNTIL GERMINATION OF GRASS.
NOTE: NAMES GIVEN ABOVE ARE REGISTERED TRADE NAMES. THIS DOES NOT CONSTITUTE A RECOMMENDATION OF THESE PRODUCTS TO THE EXCLUSION OF OTHER PRODUCTS.

B. **WOOD FIBER OR PAPER FIBER MULCH.** SHALL BE MADE FROM WOOD, PLANT FIBERS OR PAPER CONTAINING NO GROWTH OR GERMINATION INHIBITING MATERIALS, USED AT THE RATE OF 1,500 POUNDS PER ACRE (OR AS RECOMMENDED BY THE PRODUCT MANUFACTURER) AND MAY BE APPLIED BY A HYDROSEEDER. THIS MULCH SHALL NOT BE MIXED IN THE TANK WITH SEED. USE IS **LIMITED** TO FLATTER SLOPES AND DURING OPTIMUM SEEDING PERIODS IN SPRING AND FALL.

C. **PELLETIZED MULCH.** COMPRESSED AND EXTRUDED PAPER AND/OR WOOD FIBER PRODUCT, WHICH MAY CONTAIN CO-POLYMERS, TACKIFIERS, FERTILIZERS AND COLORING AGENTS. THE DRY PELLETS, WHEN APPLIED TO A SEEDED AREA AND WATERED, FORM A MULCH MAT. PELLETIZED MULCH SHALL BE APPLIED IN ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATIONS. MULCH MAY BE APPLIED BY HAND OR MECHANICAL SPREADER AT THE RATE OF 60-75 POUNDS PER 1,000 SQUARE FEET AND ACTIVATED WITH 0.2 TO 0.4 INCHES OF WATER. THIS MATERIAL HAS BEEN FOUND TO BE BENEFICIAL FOR USE ON SMALL LAWN OR RENOVATION AREAS, SEEDED AREAS WHERE WEED-SEED FREE MULCH IS DESIRED OR ON SITES WHERE STRAW MULCH AND TACKIFIER AGENT ARE NOT PRACTICAL OR DESIRABLE. APPLYING THE FULL 0.2 TO 0.4 INCHES OF WATER AFTER SPREADING PELLETIZED MULCH ON THE SEED BED IS EXTREMELY IMPORTANT FOR SUFFICIENT AND EXPANSION OF THE MULCH TO PROVIDE SOIL COVERAGE.

STANDARD FOR PERMANENT VEGETATIVE COVER FOR SOIL STABILIZATION (CONT.)

5. IRRIGATION

IF SOIL IS DEFICIENT, AND MULCH IS NOT USED, SUPPLY NEW SEEDINGS WITH ADEQUATE WATER (A MINIMUM OF 1/4 INCH TWICE A DAY UNTIL VEGETATION IS WELL ESTABLISHED). THIS IS ESPECIALLY TRUE WHEN SEEDINGS ARE MADE IN ABNORMALLY DRY OR HOT WEATHER OR ON DROUGHTY SITES.

6. TOPDRESSING

NO FOLLOW-UP OF TOPDRESSING IS MANDATORY. AN EXCEPTION MAY BE WHERE GROSS NITROGEN DEFICIENCY EXISTS TO THE EXTENT THAT TURF FAILURE MAY DEVELOP. IN THAT INSTANCE, TOPDRESS WITH 10-10-10 OR EQUIVALENT AT 400 POUNDS PER 1,000 SQUARE FEET.

7. ESTABLISHING PERMANENT VEGETATIVE STABILIZATION

THE QUALITY OF PERMANENT VEGETATION RESTS WITH THE CONTRACTOR. THE TIMING OF SEEDING, PREPARATION THE SEEDBED, APPLYING NUTRIENTS, IRRIGATION, MULCH AND OTHER MANAGEMENT ARE ESSENTIAL. THE SEED APPLICATION RATES IN TABLE 4-3 ARE REQUIRED WHEN A **REPORT OF COMPLIANCE** IS REQUESTED PRIOR TO ACTUAL ESTABLISHMENT OF PERMANENT VEGETATION. UP TO 50% REDUCTION IN APPLICATION RATES MAY BE USED WHEN PERMANENT VEGETATION IS ESTABLISHED PRIOR TO REQUESTING A **REPORT OF COMPLIANCE** FROM THE DISTRICT. THESE RATES APPLY TO ALL METHODS OF SEEDING. **ESTABLISHING PERMANENT VEGETATION MEANS 80% VEGETATIVE COVER (OF THE SEEDED SPECIES) AND MOWED ONCE.**

PERMANENT VEGETATIVE SEED MIXTURE FOR SOIL STABILIZATION FOR SOIL DISPOSAL LOCATION

REFER TO SHEET 3 OF 4 FOR PERMANENT SEED MIXTURE AND PLANTING PLAN

STANDARD FOR LAND GRADING

DEFINITION:
RESHAPING THE GROUND SURFACE BY GRADING TO PLANNED ELEVATIONS WHICH ARE DETERMINED BY TOPOGRAPHIC SURVEY AND LAYOUT.

PURPOSE:
IMPROVE SURFACE DRAINAGE AND CONTROL EROSION.

CONDITIONS WHERE PRACTICES APPLIES:
THIS PRACTICE IS APPLICABLE WHERE GRADING TO PLANNED ELEVATIONS IS PRACTICAL AND IT IS DETERMINED THAT GRADING IS NEEDED. GRADING THAT INVOLVES THE DISTURBANCE OF VEGETATION OVER LARGE AREAS SHALL BE AVOIDED. IT MAY BE NECESSARY TO PROVIDE TEMPORARY STABILIZATION OVER LARGE AREAS.

WATER QUALITY ENHANCEMENT:
PROPER GRADING OF DISTURBED SOILS WILL PROTECT AGAINST SOIL LOSS FROM EROSION, ENHANCE ESTABLISHMENT OF PERMANENT VEGETATIVE COVER AND HELP TO PROPERLY MANAGE STORMWATER RUNOFF ALL OF WHICH WILL REDUCE OFFSITE DISCHARGE OF POLLUTANTS.

PLANNING CRITERIA:
EROSION CONTROL MEASURES SHALL BE INSTALLED IN ACCORDANCE WITH THE APPLICABLE STANDARD CONTAINED HEREIN. THE CUT FACE OF EARTH EXCAVATIONS AND FILLS SHALL BE NO STEEPER THAN THE SAFE ANGLE OF REPOSE FOR THE MATERIALS ENCOUNTERED AND FLAT ENOUGH FOR MAINTENANCE AND WILL BE NO GREATER THAN THREE (3) HORIZONTAL TO ONE (1) VERTICAL IN ANY SITUATION. PERMANENTLY EXPOSED FACES OF EARTH CUTS AND FILLS SHALL BE VEGETATED OR OTHERWISE PROTECTED EROSION. PROVISIONS SHALL BE MADE TO SAFELY CONDUCT SURFACE WATER TO STORM DRAINS OR SUITABLE WATER COURSES AND PREVENT SURFACE RUNOFF FROM DAMAGING CUT FACES AND FILL SLOPES. ADJACENT PROPERTIES SHALL BE PROTECTED FROM EXCAVATION AND FILLING OPERATIONS.

STANDARD FOR DUST CONTROL

PURPOSE:
THE CONTROL OF DUST ON CONSTRUCTION SITES AND ROADS.

DEFINITION:
TO PREVENT BLOWING AND MOVEMENT OF DUST FROM EXPOSED SOIL SURFACES, REDUCED ON-SITE AND OFF-SITE DAMAGE AND HEALTH HAZARDS, AND IMPROVE TRAFFIC SAFETY.

WATER QUALITY ENHANCEMENT:
SEDIMENTS DEPOSITED AS "DUST" ARE OFTEN FINE COLLOIDAL MATERIAL WHICH IS EXTREMELY DIFFICULT TO REMOVE FROM WATER ONCE IT BECOMES SUSPENDED. USE OF THIS STANDARD WILL HELP TO CONTROL THE GENERATION OF DUST FROM CONSTRUCTION SITES AND SUBSEQUENT BLOWING AND DEPOSITION INTO LOCAL SURFACE WATER RESOURCES.

CONDITIONS WHERE PRACTICES APPLIES:
THIS PRACTICE IS APPLICABLE TO AREAS SUBJECT TO DUST BLOWING AND MOVEMENT WHERE ON-SITE AND OFF-SITE DAMAGE IS LIKELY WITHOUT TREATMENT. CONSULT WITH LOCAL MUNICIPAL ORDINANCES ON ANY RESTRICTIONS.

THE FOLLOWING METHODS SHOULD BE CONSIDERED FOR CONTROLLING DUST:

SPRAY-ON ADHESIVES: ON MINERAL SOILS (NOT EFFECTIVE ON MUCK SOILS). KEEP TRAFFIC OFF THESE AREAS.

PLANNING CRITERIA:

MATERIAL GALLONS/ACRE	WATER DILUTION	TYPE OF NOZZLE	APPLY
ANIONIC ASPHALT EMULSION	7:1	COARSE SPRAY	1200
LATEX EMULSION	12.5:1	FINE SPRAY	235
RESIN IN WATER	4:1	FINE SPRAY	300
POLYACRYLAMIDE (PAM) - SPRAY ON			
POLYACRYLAMIDE (PAM) - DRY SPREAD			
ACIDEULATED SOY BEAN SOAP STICK	NONE	COARSE SPRAY	1200

APPLY ACCORDING TO MANUFACTURER'S INSTRUCTIONS. MAY ALSO BE USED AS AN ADDITIVE TO SEDIMENT BASINS TO FLOCCULATE AND PRECIPITATE SUSPENDED COLLOIDS.

TILLAGE: TO ROUGHEN SURFACE AND BRING CLODS TO THE SURFACE. THIS IS A TEMPORARY EMERGENCY MEASURE WHICH SHOULD BE USED BEFORE SOIL BLOWING STARTS. BEGIN PLOWING ON WINDWARD SIDE OF SITE. CHISEL-TYPE PLOWS SPACED ABOUT 12 INCHES APART, AND SPRING TOOTHED HARROWS ARE EXAMPLES OF EQUIPMENT WHICH MAY PRODUCE THE DESIRED EFFECT.

SPRINKLING: BROADCAST APPLICATION OF WATER UNTIL THE SURFACE IS WET.

BARRIERS: SOLID BOARD FENCES, SNOW FENCES, BURLAP FENCES, CRATE WALLS, BALES OF HAY, AND SIMILAR MATERIAL CAN BE USED TO CONTROL AIR CURRENTS AND SOIL BLOWING.

CALCIUM CHLORIDE: SHALL BE IN THE FORM OF LOOSE, DRY GRANULES OR FLAKES FINE ENOUGH TO FEED THROUGH COMMONLY USED SPREADERS AT A RATE THAT WILL KEEP SURFACE MOIST BUT NOT CAUSE POLLUTION OR PLANT DAMAGE. IF USED ON STEEPER SLOPES, THEN USE OTHER PRACTICES TO PREVENT WASHING INTO STREAMS, OR ACCUMULATION AROUND PLANTS. NOT TO BE USED IN RETROFIT AREA, APPLICABLE ONLY TO UPLAND AREAS

STONE: COVER SURFACE WITH CRUSHED STONE OR COARSE GRAVEL.

TABLE 4-1

LIMESTONE[1] APPLICATION RATE BY SOIL TEXTURE	
SOIL TEXTURE	TONS / ACRE
CLAY, CLAY LOAM, AND HIGH ORGANIC SOIL	3
SANDY LOAM, LOAM, SILT LOAM	2
LOAMY SAND, SAND	1

1 PULVERIZED DOLOMITIC LIMESTONE IS PREFERRED FOR MOST SOILS SOUTH OF THE NEW BRUNSWICK - TRENTON LINE.

STANDARD FOR MANAGEMENT OF HIGH ACID PRODUCING SOILS

DEFINITION

IDENTIFYING HIGH ACID PRODUCING SOIL WHICH MAY BE EXPOSED DURING EXCAVATION AND LAND GRADING ACTIVITIES AND PRACTICES FOR ITS BURIAL. HIGH ACID PRODUCING SOILS ARE SOIL WITH A PH OF 4 OR LESS OR CONTAIN IRON SULFIDE.

PURPOSE

TO PREVENT OR LIMIT EXPOSURE, EXPOSURE TIME AND SPREADING BY EQUIPMENT OR RAINFALL ON AND OFF SITE AND MINIMIZE EROSION, SEDIMENTATION AND ACID LEACHATE RELATED DAMAGES.

BY ITS EXPOSURE TO AIR, SOILS CONTAINING IRON SULFIDE, CHARACTERIZED BY PYRITE OR MARCASITE NUGGETS OR GREEN SANDS, CAUSES CHEMICAL OXIDATION TO OCCUR PRODUCING SULFURIC ACID AND RESULTS IN SOIL PH LEVELS FALLING TO PH 3 AND LOWER. MOST VEGETATION IS INCAPABLE OF GROWTH AT THIS PH LEVEL. ADJACENT LAND AND RECEIVING WATERS WILL BE NEGATIVELY IMPACTED BY THE ACID LEACHATE. CALCIUM CONTAINING MATERIALS SUCH AS SIDEWALKS, CULVERTS AND OTHER STRUCTURES AND SOME METALLIC MATERIALS ARE ALSO SUSCEPTIBLE TO DEGRADATION. AGRICULTURAL LIMESTONE MATERIALS APPLIED AT RATES OF 8 TONS PER ACRE HAVE RESULTED IN ONLY A TEMPORARY BUFFERING EFFECT AN "LIMING-ONLY" IS THEREFORE NOT CONSIDERED AN ACCEPTABLE MITIGATION PRACTICE.

WATER QUALITY ENHANCEMENT

PROTECTS ON SITE SOILS AND OFFSITE STREAMS AND LAKES FROM SULFURIC ACID LEACHATE WHICH CREATES SOIL PH CONDITIONS UNSUITABLE FOR GROWTH OF VEGETATION.

WHERE APPLICABLE

THIS PRACTICE IS APPLICABLE TO ANY HIGH ACID PRODUCING SOIL MATERIALS. SUCH MATERIALS HAVE BEEN FOUND IN THE COASTAL PLAIN AREAS OF BURLINGTON, CAMDEN, MERCER, MIDDLESEX, MONMOUTH, OCEAN AND SALEM COUNTIES.

PLANNING CRITERIA

EARLY RECOGNITION AND BURIAL, REMOVAL OR DISPOSAL OF HIGH ACID PRODUCING SOILS IS ESSENTIAL FOR LIMITING THE AMOUNT OF ACIDIC MATERIAL PRODUCED.

REVIEW A SURFACE GEOLOGY MAP FOR THE PROPOSED SITE TO INVESTIGATE THE PRESENCE OF GEOLOGIC FORMATIONS WHICH COMMONLY CONTAIN HIGH ACID PRODUCING DEPOSITS. THE GEOLOGIC FORMATIONS ARE AS FOLLOWS:

ENGLISHTOWN SAND	NAVESINK FORMATION
KIRKWOOD FORMATION	RARITAN FORMATION
MAGOTHY FORMATION	RED BANK SAND
MARSHALLTOWN FORMATION	WOODBURY CLAY
MERCHANTVILLE FORMATION	

CONTACT THE LOCAL SOIL CONSERVATION DISTRICT TO DETERMINE THE HISTORICAL PRESENCE OF HIGH ACID PRODUCING SOILS IN THE VICINITY OF THE PROPOSED SITE.

HIGH ACID PRODUCING SOILS MAY BE PRESENT IN UNDISTURBED SOILS AT VARYING DEPTHS INCLUDING NEAR THE SOIL SURFACE TO EXCAVATIONS OR DEEP DISTURBANCES. ITS PRESENCE ON A SITE MAY BE SIGNIFICANT OR LIMITED IN THE SOIL PROFILE. HIGH ACID PRODUCING SOILS ARE COMMONLY BLACK, DARK BROWN, GRAY OR GREENISH WITH SILVERY PYRITE OR MARCASITE NUGGETS OR FLAKES.

ALTERNATIVELY, SANDY SOILS OF REDDISH, YELLOWISH OR LIGHT TO MEDIUM BROWN SOIL MATERIALS ARE USUALLY FREE OF HIGH ACID PRODUCING DEPOSITS.

METHODS AND MATERIALS

1. LIMIT THE EXCAVATION AREA AND EXPOSURE TIME WHEN HIGH ACID PRODUCING SOILS ARE ENCOUNTERED.

2. TOPSOIL STRIPPED FROM THE SITE SHALL BE STORED SEPARATELY FROM TEMPORARILY STOCKPILED HIGH ACID PRODUCING SOILS.

3. STOCKPILES OF HIGH ACID PRODUCING SOIL SHOULD BE LOCATED ON LEVEL LAND TO MINIMIZE ITS MOVEMENT, ESPECIALLY WHEN THIS MATERIAL HAS HIGH CLAY CONTENT.

4. TEMPORARILY STOCKPILED HIGH ACID PRODUCING SOIL MATERIAL TO BE EXPOSED MORE THAN 30 DAYS SHOULD BE COVERED WITH PROPERLY ANCHORED, HEAVY GRADE SHEETS OF POLYETHYLENE WHERE POSSIBLE. IF NOT POSSIBLE, STOCKPILES SHALL BE COVERED WITH A MINIMUM OF 3 TO 6 INCHES OF WOOD CHIPS TO MINIMIZE EROSION OF THE STOCKPILE. SILT FENCE SHALL BE INSTALLED AT THE TOE OF SLOPE TO CONTAIN MOVEMENT OF THE STOCKPILED MATERIAL. TOPSOIL SHALL NOT BE APPLIED TO THE STOCKPILES TO PREVENT TOPSOIL CONTAMINATION WITH HIGH ACID PRODUCING SOIL.

5. HIGH ACID PRODUCING SOILS WITH A PH OF 4 OR LESS, OR CONTAINING IRON SULFIDE, (INCLUDING BORROW FROM CUTS) SHALL BE ULTIMATELY PLACED OR BURIED WITH LIMESTONE APPLIED AT THE RATE OF 6 TONS PER ACRE (OR 275 POUNDS PER 1,000 SQUARE FEET OF SURFACE AREA) AND COVERED WITH A MINIMUM OF 12 INCHES OF SETTLED SOIL WITH A PH OF 5 OR MORE EXCEPT AS FOLLOWS:

a. AREAS WHERE TREES OR SHRUBS ARE TO BE PLANTED SHALL BE COVERED WITH A MINIMUM OF 24 INCHES OF SOIL WITH A PH OF 5 OR MORE.
b. DISPOSAL AREAS SHALL NOT BE LOCATED WITHIN 24 INCHES OF ANY SURFACE OF A SLOPE OR BANK, SUCH AS BERMS, STREAM BANKS, DITCHES AND OTHERS TO PREVENT POTENTIAL LATERAL LEACHING DAMAGES.

6. EQUIPMENT USED FOR MOVEMENT OF HIGH ACID PRODUCING SOILS SHOULD BE CLEANED AT THE END OF EACH DAY TO PREVENT SPREADING OF HIGH ACID SOIL MATERIALS TO OTHERS PARTS OF THE SITE, INTO STREAMS OR STORMWATER CONVEYANCES AND TO PROTECT MACHINERY FROM ACCELERATED RUSTING.

7. NON VEGETATIVE EROSION CONTROL PRACTICES (STONE TRACKING PADS, STRATEGICALLY PLACED LIMESTONE CHECK DAM, SILT FENCE, WOOD CHIPS) SHOULD BE INSTALLED TO LIMIT THE MOVEMENT OF HIGH ACID PRODUCING SOILS FROM, AROUND OR OFF THE SITE.

8. FOLLOWING BURIAL OR REMOVAL OF HIGH ACID PRODUCING SOIL, TOPSOILING AND SEEDING OF THE SITE, (SEE TEMPORARY VEGETATIVE COVER FOR SOIL STABILIZATION, PERMANENT VEGETATIVE COVER FOR SOIL STABILIZATION, AND TOPSOILING) MONITORING SHOULD CONTINUE FOR APPROXIMATELY 6 TO 12 MONTHS TO ASSURE THERE IS ADEQUATE STABILIZATION AND THAT NO HIGH ACID SOIL PROBLEMS EMERGE. IF PROBLEMS STILL EXIST THE AFFECTED AREA MUST BE TREATED AS INDICATED ABOVE TO CORRECT THE PROBLEM.

9. MONITORING OF AREAS WHERE HIGH ACID PRODUCING SOIL HAS BEEN PLACED OR BURIED SHOULD BE PERFORMED FOR AT LEAST 2 YEARS OR LONGER IF PROBLEMS OCCUR, TO ASSURE THERE IS NO MIGRATION OF POTENTIAL ACID LEACHATE.

FREEHOLD SOIL EROSION AND SEDIMENT CONTROL NOTES:

1. THE FREEHOLD SOIL CONSERVATION DISTRICT SHALL BE NOTIFIED SEVENTY-TWO (72) HOURS IN ADVANCE OF ANY LAND DISTURBING ACTIVITY.

2. ALL WORK IS TO BE DONE IN ACCORDANCE WITH THE STATE STANDARDS FOR SOIL EROSION AND SEDIMENT CONTROL OF NEW JERSEY.

3. ALL SOIL EROSION AND SEDIMENT CONTROL PRACTICES ARE TO BE INSTALLED PRIOR TO ANY MAJOR SOIL DISTURBANCE, OR IN THEIR PROPER SEQUENCE, AND MAINTAINED UNTIL PERMANENT PROTECTION IS ESTABLISHED.

4. ANY CHANGES TO THE CERTIFIED SOIL EROSION AND SEDIMENT CONTROL PLANS WILL REQUIRE THE SUBMISSION OF REVISED SOIL EROSION AND SEDIMENT CONTROL PLANS TO THE DISTRICT FOR RE-CERTIFICATION. THE REVISED PLANS MUST MEET ALL CURRENT STATE SOIL EROSION AND SEDIMENT CONTROL STANDARDS.

5. IN THAT NJSA 4:24-39 ET. SEQ. REQUIRES THAT NO CERTIFICATES OF OCCUPANCY BE ISSUED BEFORE THE PROVISIONS OF THE CERTIFIED PLAN FOR EROSION CONTROL HAVE BEEN COMPLIED WITH FOR PERMANENT MEASURES. ALL SITE WORK AND ALL WORK AROUND INDIVIDUAL LOTS IN SUBDIVISIONS, WILL HAVE TO BE COMPLETED PRIOR TO THE DISTRICT ISSUING A REPORT OF COMPLIANCE FOR THE ISSUANCE OF A CERTIFICATE OF OCCUPANCY BY THE MUNICIPALITY.

6. ANY DISTURBED AREAS THAT WILL BE LEFT EXPOSED MORE THAN THIRTY (30) DAYS, AND NOT SUBJECT TO CONSTRUCTION TRAFFIC, WILL IMMEDIATELY RECEIVE A TEMPORARY SEEDING. IF THE SEASON PREVENTS THE ESTABLISHMENT OF TEMPORARY COVER, THE DISTURBED AREAS WILL BE MULCHED WITH STRAW, OR EQUIVALENT MATERIAL, AT A RATE OF 2 TO 2 $\frac{1}{2}$ TONS PER ACRE, ACCORDING TO STATE STANDARD FOR STABILIZATION WITH MULCH ONLY.

7. IMMEDIATELY FOLLOWING INITIAL DISTURBANCE OR ROUGH GRADING, ALL CRITICAL AREAS SUBJECT TO EROSION (I.E. STEEP SLOPES AND ROADWAY EMBANKMENTS) WILL RECEIVE TEMPORARY SEEDING IN COMBINATION WITH STRAW MULCH OR A SUITABLE EQUIVALENT, AT A RATE OF 1 1/2 TO 2 TONS PER ACRE, ACCORDING TO STATE STANDARDS.

8. A SUB-BASE COURSE WILL BE APPLIED IMMEDIATELY FOLLOWING ROUGH GRADING AND INSTALLATION OF IMPROVEMENTS TO STABILIZE STREETS, ROADS, DRIVEWAYS, AND PARKING AREAS. IN AREAS WHERE NO UTILITIES ARE PRESENT, THE SUB-BASE SHALL BE INSTALLED WITHIN FIFTEEN (15) DAYS OF THE PRELIMINARY GRADING.

9. ANY STEEP SLOPES RECEIVING PIPELINE INSTALLATION WILL BE BACKFILLED AND STABILIZED DAILY, AS THE INSTALLATION CONTINUES (I.E. SLOPES GREATER THAN 3:1).

10. THE STANDARD FOR STABILIZED CONSTRUCTION ACCESS REQUIRES THE INSTALLATION OF A PAD OF CLEAN CRUSHED STONE AT POINTS WHERE TRAFFIC WILL BE ACCESSING THE CONSTRUCTION SITE. AFTER INTERIOR ROADWAYS ARE PAVED, INDIVIDUAL LOTS REQUIRE A STABILIZED CONSTRUCTION ENTRANCE CONSISTING OF ONE INCH TO TWO INCH (1"-2") STONE FOR A MINIMUM LENGTH OF TEN FEET (10') EQUAL TO THE LOT ENTRANCE WIDTH. ALL OTHER ACCESS POINTS SHALL BE BLOCKED OFF.

11. ALL SOIL WASHED, DROPPED, SPILLED, OR TRACKED OUTSIDE THE LIMIT OF DISTURBANCE OR ONTO PUBLIC RIGHT-OF-WAYS WILL BE REMOVED IMMEDIATELY.

12. PERMANENT VEGETATION IS TO BE SEEDED OR SODDED ON ALL EXPOSED AREAS WITHIN TEN (10) DAYS AFTER FINAL GRADING.

13. AT THE TIME THAT SITE PREPARATION FOR PERMANENT VEGETATIVE STABILIZATION IS GOING TO BE ACCOMPLISHED, ANY SOIL THAT WILL NOT PROVIDE A SUITABLE ENVIRONMENT TO SUPPORT ADEQUATE VEGETATIVE GROUND COVER SHALL BE REMOVED OR TREATED IN SUCH A WAY THAT IT WILL PERMANENTLY ADJUST THE SOIL CONDITIONS AND RENDER IT SUITABLE FOR VEGETATIVE GROUND COVER. IF THE REMOVAL OR TREATMENT OF THE SOIL WILL NOT PROVIDE SUITABLE CONDITIONS, NON-VEGETATIVE MEANS OF PERMANENT GROUND STABILIZATION WILL HAVE TO BE EMPLOYED.

14. IN ACCORDANCE WITH THE STANDARD FOR MANAGEMENT OF HIGH ACID PRODUCING SOILS, ANY SOIL HAVING A PH OF 4 OR LESS OR CONTAINING IRON SULFIDES SHALL BE COVERED WITH A MINIMUM OF TWELVE (12) INCHES OF SOIL HAVING A PH OF 5 OR MORE PRIOR TO SEEDBED PREPARATION. AREAS WHERE TREES OR SHRUBS ARE TO BE PLANTED SHALL BE COVERED WITH A MINIMUM OF TWENTY- FOUR (24) INCHES OF SOIL HAVING A PH OF 5 OR MORE.

15. CONDUIT OUTLET PROTECTION MUST BE INSTALLED AT ALL REQUIRED OUTFALLS PRIOR TO THE DRAINAGE SYSTEM BECOMING OPERATIONAL.

16. UNFILTERED DEWATERING IS NOT PERMITTED. NECESSARY PRECAUTIONS MUST BE TAKEN DURING ALL DEWATERING OPERATIONS TO MINIMIZE SEDIMENT TRANSFER. ANY DEWATERING METHODS USED MUST BE IN ACCORDANCE WITH THE STANDARD FOR DEWATERING.

17. SHOULD THE CONTROL OF DUST AT THE SITE BE NECESSARY, THE SITE WILL BE SPRINKLED UNTIL THE SURFACE IS WET, TEMPORARY VEGETATIVE COVER SHALL BE ESTABLISHED OR MULCH SHALL BE APPLIED AS REQUIRED BY THE STANDARD FOR DUST CONTROL.

18. STOCKPILE AND STAGING LOCATIONS ESTABLISHED IN THE FIELD SHALL BE PLACED WITHIN THE LIMIT OF DISTURBANCE ACCORDING TO THE CERTIFIED PLAN. STAGING AND STOCKPILES NOT LOCATED WITHIN THE LIMIT OF DISTURBANCE WILL REQUIRE CERTIFICATION OF A REVISED SOIL EROSION AND SEDIMENT CONTROL PLAN. CERTIFICATION OF A NEW SOIL EROSION AND SEDIMENT CONTROL PLAN MAY BE REQUIRED FOR THESE ACTIVITIES IF AN AREA GREATER THAN 5,000 SQUARE FEET IS DISTURBED.

19. ALL SOIL STOCKPILES ARE TO BE TEMPORARILY STABILIZED IN ACCORDANCE WITH SOIL EROSION AND SEDIMENT CONTROL NOTE #6.

20. THE PROPERTY OWNER SHALL BE RESPONSIBLE FOR ANY EROSION OR SEDIMENTATION THAT MAY OCCUR BELOW STORMWATER OUTFALLS OR OFFSITE AS A RESULT OF CONSTRUCTION OF THE PROJECT.

CALL BEFORE YOU DIG!
NEW JERSEY LAW REQUIRES
3 WORKING DAYS NOTICE FOR
CONSTRUCTION PHASE AND 10 WORKING
DAYS IN DESIGN STAGE – STOP CALL
NEW JERSEY ONE CALL SYSTEM, INC.
REFERENCE NEW JERSEY TITLE 48, CHPT. 2, ARTICLE 9
1-800-272-1000

PROJECT NOTES

GENERAL NOTES:

1. 72 HOURS PRIOR TO ANY SOIL DISTURBANCE, NOTICE IN WRITING, SHALL BE GIVEN TO THE FREEHOLD SOIL CONSERVATION DISTRICT.

DATE	DESCRIPTION

REVISIONS

STATE OF NEW JERSEY CERTIFICATE OF AUTH. NO.: 24GA27976800

KEITHE J. MERL
Professional Engineer
NJ Lic. No. GE44839

DATE

PRINCETON HYDRO, LLC
SCIENTISTS AND ENGINEERS
120 EAST UWCHLAN AVENUE
SUITE 204
EXTON, PENNSYLVANIA 19341
PHONE. 610.524.4220
FAX. 610.514.9434
WWW.PRINCETONHYDRO.COM

PROJECT NAME/LOCATION:
MANALAPAN LAKE
SHORELINE STABILIZATION
AT STATION 37, THOMPSON PARK
MIDDLESEX COUNTY, NEW JERSEY

DRAWING NAME:
EROSION AND
SEDIMENT CONTROL NOTES

DATE:	02/28/2011
PROJECT NO.:	0457.008
SCALE:	NOT TO SCALE
DRAWN BY:	JEO
CHECKED BY:	CHE/KJM

SHEET NO.
4 OF 4

STREAMBANK STABILIZATION AND FLOODPLAIN RESTORATION

AT STATION #48

MONROE BOULEVARD
TOWNSHIP OF MONROE
MIDDLESEX COUNTY, NEW JERSEY

GENERAL NOTES:

1. ALL ELEVATIONS AND QUANTITIES ARE BASED ON IN-SITU CONDITIONS AS OF THE DATE OF SURVEY (DECEMBER 9, 2010). ONCE DISTURBED, MATERIAL CONDITIONS CAN VARY SIGNIFICANTLY.

2. THE APPROVAL AND USE OF THESE PLANS ARE FOR THE PROJECT OWNER AS DEPICTED ON THIS SHEET. THIS PLAN IS NOT TO BE UTILIZED IN THE PREPARATION OF ANY OTHER PROJECTS.

3. AS FIELD CONDITIONS MAY REQUIRE MODIFICATIONS TO PROPOSED TOPOGRAPHIC ELEVATIONS AND FACILITY LOCATIONS, THESE PLANS ARE NOT TO BE UTILIZED FOR AS-BUILTS OR FOR PURPOSES OTHER THAN STATED HEREIN.

4. THESE PLANS ARE NOT TO BE UTILIZED FOR CONSTRUCTION, UNTIL ALL REQUIRED LOCAL, STATE, AND FEDERAL PERMITS ARE OBTAINED.

CONSTRUCTION NOTES:

1. SOIL, ROCK, OR OTHER MATERIALS TO BE UTILIZED FOR FILLING OR BACKFILLING SHALL BE APPROVED BY A QUALIFIED GEOTECHNICAL ENGINEER.

2. ALL MATERIALS SHALL CONFORM TO THE LATEST AMERICAN STANDARDS FOR TESTING AND MATERIALS SPECIFICATIONS (ASTM).

3. PROXIMITY OF STOCKPILES TO THE EDGE OF EXCAVATIONS SHALL BE SUCH THAT THE INFLUENCE OF THE STOCKPILE SURCHARGE ON THE MODIFIED OR EXISTING SLOPE IS REDUCED. WHERE POSSIBLE STOCKPILES WILL BE PLACED A DISTANCE FROM THE EDGE OF EXCAVATION EQUAL TO (OR GREATER THAN) THE HEIGHT OF THE EXCAVATION.

4. ALL STOCKPILED MATERIAL PROPOSED FOR USE WILL BE PROTECTED FROM EXCESSIVE LOSS OR GAIN OF MOISTURE USING SECURELY ANCHORED PLASTIC COVERS OR EQUIVALENT METHODS.

5. UTILITIES SHALL BE LOCATED BY THE CONTRACTOR PRIOR TO CONSTRUCTION.

6. NECESSARY PRECAUTIONS SHALL BE TAKEN BY THE CONTRACTOR TO PROTECT EXISTING SERVICES AND MAINS. ANY DAMAGE TO EXISTING SERVICES OR MAINS SHALL BE REPAIRED IMMEDIATELY AT THE CONTRACTORS EXPENSE.

7. EXCAVATIONS AND STOCKPILES IN NO WAY SHALL HAVE SLOPES STEEPER THAN 2:1.

8. THE CONTRACTOR SHALL NOTE THAT IN THE CASE OF A DISCREPANCY BETWEEN THE SCALED AND THE FIGURED DIMENSIONS SHOWN ON THESE PLANS, THE FIGURED DIMENSIONS SHALL APPLY.

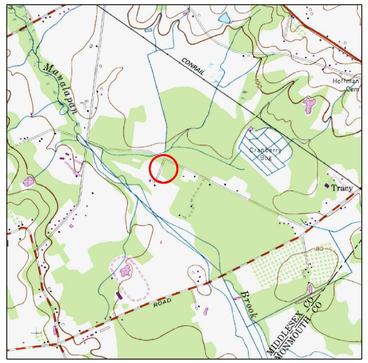
9. IT SHALL BE DISTINCTLY UNDERSTOOD THAT FAILURE TO MENTION SPECIFICALLY ANY WORK THAT WOULD NORMALLY BE REQUIRED TO COMPLETE THE PROJECT, SHALL NOT RELIEVE THE CONTRACTOR OF RESPONSIBILITY TO PERFORM THE WORK.

10. IT SHALL BE THE CONTRACTORS RESPONSIBILITY TO ASSURE THE ACCURACY OF THE PROPERTY BOUNDARIES.

11. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE REPAIR AND REPLACEMENT OF PROPERTY DAMAGE TO FENCES, SIGNS, STRUCTURES, VEGETATION, IRRIGATION, LANDSCAPING COMPONENTS, AND ANY OTHER PROPERTY ITEMS THAT ARE REMOVED FOR THE PURPOSES OF THE PROJECT LOGISTICS AND ACCIDENTS.

12. EXISTING ASPHALT SURFACES SHALL REMAIN UNDISTURBED EXCEPT FOR THE PROPOSED WORK AS CALLED FOR ON THESE PLANS. ANY DAMAGE TO THESE ASPHALT SURFACES SHALL BE THE SOLE RESPONSIBILITY OF THE CONTRACTOR AND ALL COSTS FOR REPAIRS SHALL BE BORNE BY THE CONTRACTOR.

13. THE CONTRACTOR SHALL PROVIDE NECESSARY MAINTENANCE AND PROTECTION OF TRAFFIC MEASURES.



A PROJECT VICINITY
SCALE: 1" = 2000'
USGS QUADRANGLE
7.5 MINUTE SERIES
JAMESBURG, NEW JERSEY QUADRANGLE

B 2007 ORTHOIMAGERY
SITE LOCATION
1" = 2000'

CONSTRUCTION SAFETY AND SECURITY:

1. ALL CONSTRUCTION SHALL ADHERE TO OSHA STANDARDS AND REGULATIONS.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PURCHASE AND INSTALLATION OF HIGH VISIBILITY FENCING TO BE PLACED ALONG THE PROJECT PERIMETER, WARNING SIGNS SHALL ALSO BE PROVIDED.
3. THE CONTRACTOR SHALL PROVIDE CONSTRUCTION WARNING SIGNS AND TRAFFIC CONTROL AS REQUIRED BY THE NJ DEPARTMENT OF TRANSPORTATION WITH REGARD TO ACCESS OF CONSTRUCTION VEHICLES AND TRUCKS UTILIZING MUNICIPAL OF STATE ROADWAYS.

PREPARED FOR:

NEW JERSEY WATER SUPPLY AUTHORITY
ON BEHALF OF THE MANALAPAN BROOK
WATERSHED RESTORATION AND PROTECTION
PLAN PROJECT COMMITTEE
WATERSHED PROTECTION PROGRAMS
74 EAST MAIN STREET
SOMERVILLE, NJ 08876-2312
P. 908.685.0315

SHEET INDEX:

SHEET 1 - TITLE SHEET
SHEET 2 - EXISTING CONDITIONS
SHEET 3 - PROPOSED CONDITIONS
SHEET 4 - SOIL EROSION AND SEDIMENT CONTROL / LANDSCAPE PLAN
SHEET 5 - SOIL EROSION AND SEDIMENT CONTROL DETAILS
SHEET 6 - SOIL EROSION AND SEDIMENT CONTROL NOTES

CALL BEFORE YOU DIG!
NEW JERSEY LAW REQUIRES
3 WORKING DAYS NOTICE FOR
CONSTRUCTION PHASE AND 10 WORKING
DAYS IN DESIGN STAGE – STOP CALL
NEW JERSEY ONE CALL SYSTEM, INC.
REFERENCE NEW JERSEY TITLE 48, CHPT. 2, ARTICLE 9
1-800-272-1000

PROJECT NOTES

1. TOPOGRAPHIC SURVEY DATA SHOWN ON THIS PLAN ARE BASED ON FIELD WORK PERFORMED BY J. TIMOTHY KERNAN, INC. FROM NOVEMBER 17, 2010 THRU DECEMBER 9, 2010, OBTAINED IN DIGITAL FORMAT DECEMBER 2010.

2. VERTICAL DATUM IS BASED ON NAVD88, FEET. HORIZONTAL IS BASED ON NAD83, FEET.

3. THE ENTIRE PROJECT AREA IS WITHIN THE 100-YR FLOODPLAIN OF THE MANALAPAN BROOK AS PER THE EFFECTIVE FEMA FLOOD INSURANCE RATE MAP (FIRM), AND THE STATE DELINEATED FLOOD HAZARD AREA (NJFHA). THE ENTIRE PROJECT SITE IS ALSO WITHIN THE 150' RIPARIAN ZONE FOR THE UNNAMED TRIBUTARY TO MANALAPAN BROOK ON WHICH THE PROJECT IS PROPOSED.

4. PROJECT IS LOCATED ENTIRELY WITHIN BLOCK 23, LOT 21.02 (SOUTH OF MONROE BOULEVARD). AUTHORIZATION FROM THE LANDOWNER WILL BE REQUIRED PRIOR TO PERMITTING AND IMPLEMENTATION OF CONSTRUCTION.

5. ADDITIONAL DIGITAL PROPERTY BOUNDARY/EASEMENT INFORMATION WAS NOT AVAILABLE AT THE TIME OF PLAN PREPARATION. THIS INFORMATION WILL BE REQUIRED FOR PERMIT SUBMISSION.

6. NO WETLAND DELINEATION, OR ANY OTHER REGULATORY BOUNDARY DELINEATION HAS BEEN COMPLETED FOR THIS PROJECT AT THE TIME OF PLAN PREPARATION. THIS INFORMATION WILL BE REQUIRED FOR PERMIT SUBMISSION.

7. EXISTING MONROE BOULEVARD CULVERT (IDENTIFIED AS #SC81 BY MIDDLESEX COUNTY) AT THIS LOCATION IS CURRENTLY UNDER DESIGN FOR REPLACEMENT BY DELAWARE RARITAN ENGINEERING. FOR LATEST INFORMATION REGARDING STATUS OF THE CULVERT REPLACEMENT PROJECT, RON SENDNER OF MIDDLESEX COUNTY ENGINEERING DEPARTMENT CAN BE CONTACTED AT (732) 745-3248.

DATE	DESCRIPTION

REVISIONS

STATE OF NEW JERSEY CERTIFICATE OF AUTH. NO.: 24GA27976800

JACOB E. HELMINIAK
Professional Engineer
NJ Lic. No. GE-46967

DATE

PRINCETON HYDRO, LLC
SCIENTISTS AND ENGINEERS
120 EAST UWCHLAN AVENUE
SUITE 204
EXTON, PENNSYLVANIA 19341
PHONE. 610.524.4220
FAX. 610.514.9434
WWW.PRINCETONHYDRO.COM

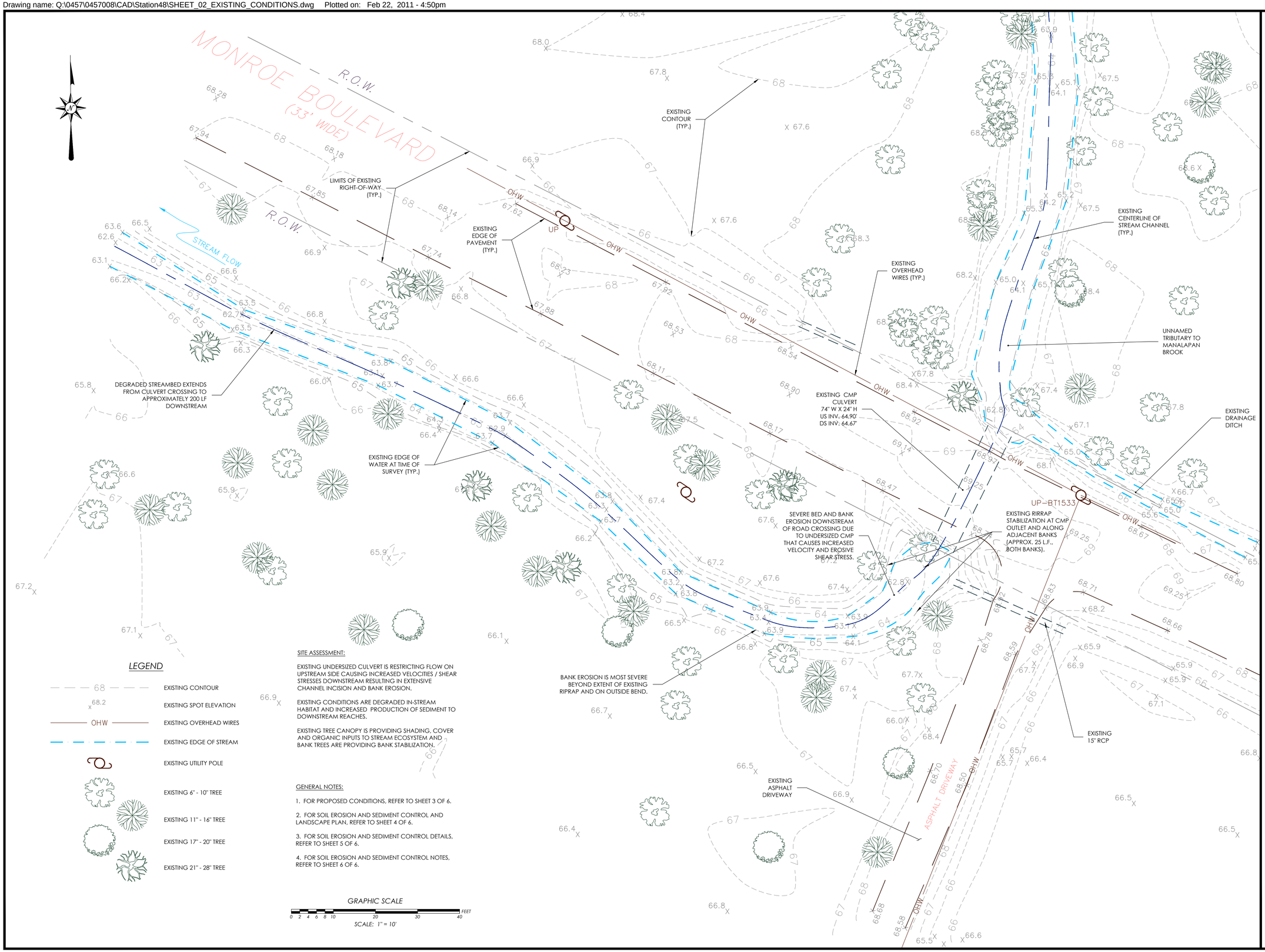
PROJECT NAME/LOCATION:
STREAMBANK STABILIZATION AND FLOODPLAIN RESTORATION -- STATION #48
TOWNSHIP OF MONROE
MIDDLESEX COUNTY, NEW JERSEY

DRAWING NAME:
TITLE SHEET

DATE:	04/12/2010
PROJECT NO.:	0457.008
SCALE:	AS SHOWN
DRAWN BY:	JH/PW
CHECKED BY:	JH/CE

SHEET NO.
1 OF 6

Drawing name: Q:\0457\0457008\CAD\Station48\SHEET_02_EXISTING_CONDITIONS.dwg Plotted on: Feb 22, 2011 - 4:50pm



LEGEND

- EXISTING CONTOUR
- EXISTING SPOT ELEVATION
- EXISTING OVERHEAD WIRES
- EXISTING EDGE OF STREAM
- EXISTING UTILITY POLE
- EXISTING 6" - 10" TREE
- EXISTING 11" - 16" TREE
- EXISTING 17" - 20" TREE
- EXISTING 21" - 28" TREE

SITE ASSESSMENT:

EXISTING UNDERSIZED CULVERT IS RESTRICTING FLOW ON UPSTREAM SIDE CAUSING INCREASED VELOCITIES / SHEAR STRESSES DOWNSTREAM RESULTING IN EXTENSIVE CHANNEL INCISION AND BANK EROSION.

EXISTING CONDITIONS ARE DEGRADED IN-STREAM HABITAT AND INCREASED PRODUCTION OF SEDIMENT TO DOWNSTREAM REACHES.

EXISTING TREE CANOPY IS PROVIDING SHADING, COVER AND ORGANIC INPUTS TO STREAM ECOSYSTEM AND BANK TREES ARE PROVIDING BANK STABILIZATION.

GENERAL NOTES:

1. FOR PROPOSED CONDITIONS, REFER TO SHEET 3 OF 6.
2. FOR SOIL EROSION AND SEDIMENT CONTROL AND LANDSCAPE PLAN, REFER TO SHEET 4 OF 6.
3. FOR SOIL EROSION AND SEDIMENT CONTROL DETAILS, REFER TO SHEET 5 OF 6.
4. FOR SOIL EROSION AND SEDIMENT CONTROL NOTES, REFER TO SHEET 6 OF 6.

GRAPHIC SCALE

0 2 4 6 8 10 20 30 40 FEET

SCALE: 1" = 10'

CALL BEFORE YOU DIG!
NEW JERSEY LAW REQUIRES
3 WORKING DAYS NOTICE FOR CONSTRUCTION PHASE AND 10 WORKING DAYS IN DESIGN STAGE – STOP CALL
NEW JERSEY ONE CALL SYSTEM, INC.
REFERENCE NEW JERSEY TITLE 48, CHPT. 2, ARTICLE 9
1-800-272-1000

PROJECT NOTES

1. TOPOGRAPHIC SURVEY DATA SHOWN ON THIS PLAN ARE BASED ON FIELD WORK PERFORMED BY J. TIMOTHY KERNAN, INC. FROM NOVEMBER 17, 2010 THRU DECEMBER 9, 2010, OBTAINED IN DIGITAL FORMAT DECEMBER 2010.

2. VERTICAL DATUM IS BASED ON NAVD88, FEET. HORIZONTAL IS BASED ON NAD83, FEET.

3. THE ENTIRE PROJECT AREA IS WITHIN THE 100-YR FLOODPLAIN OF THE MANALAPAN BROOK AS PER THE EFFECTIVE FEMA FLOOD INSURANCE RATE MAP (FIRM), AND THE STATE DELINEATED FLOOD HAZARD AREA (NJFHA). THE ENTIRE PROJECT SITE IS ALSO WITHIN THE 150' RIPARIAN ZONE FOR THE UNNAMED TRIBUTARY TO MANALAPAN BROOK ON WHICH THE PROJECT IS PROPOSED.

4. PROJECT IS LOCATED ENTIRELY WITHIN BLOCK 23, LOT 21.02 (SOUTH OF MONROE BOULEVARD). AUTHORIZATION FROM THE LANDOWNER WILL BE REQUIRED PRIOR TO PERMITTING AND IMPLEMENTATION OF CONSTRUCTION.

5. ADDITIONAL DIGITAL PROPERTY BOUNDARY/EASEMENT INFORMATION WAS NOT AVAILABLE AT THE TIME OF PLAN PREPARATION. THIS INFORMATION WILL BE REQUIRED FOR PERMIT SUBMISSION.

6. NO WETLAND DELINEATION, OR ANY OTHER REGULATORY BOUNDARY DELINEATION HAS BEEN COMPLETED FOR THIS PROJECT AT THE TIME OF PLAN PREPARATION. THIS INFORMATION WILL BE REQUIRED FOR PERMIT SUBMISSION.

7. EXISTING MONROE BOULEVARD CULVERT (IDENTIFIED AS #SC81 BY MIDDLESEX COUNTY) AT THIS LOCATION IS CURRENTLY UNDER DESIGN FOR REPLACEMENT BY DELAWARE RARITAN ENGINEERING. FOR LATEST INFORMATION REGARDING STATUS OF THE CULVERT REPLACEMENT PROJECT, RON SENDNER OF MIDDLESEX COUNTY ENGINEERING DEPARTMENT CAN BE CONTACTED AT (732) 745-3248.

DATE	DESCRIPTION

REVISIONS

STATE OF NEW JERSEY CERTIFICATE OF AUTH. NO.: 24GA27976800

JACOB E. HELMINIAK
Professional Engineer
NJ Lic. No. GE-46967

DATE

PRINCETON HYDRO, LLC
SCIENTISTS AND ENGINEERS
120 EAST UWCHLAN AVENUE
SUITE 204
EXTON, PENNSYLVANIA 19341
PHONE. 610.524.4220
FAX. 610.514.9434
WWW.PRINCETONHYDRO.COM

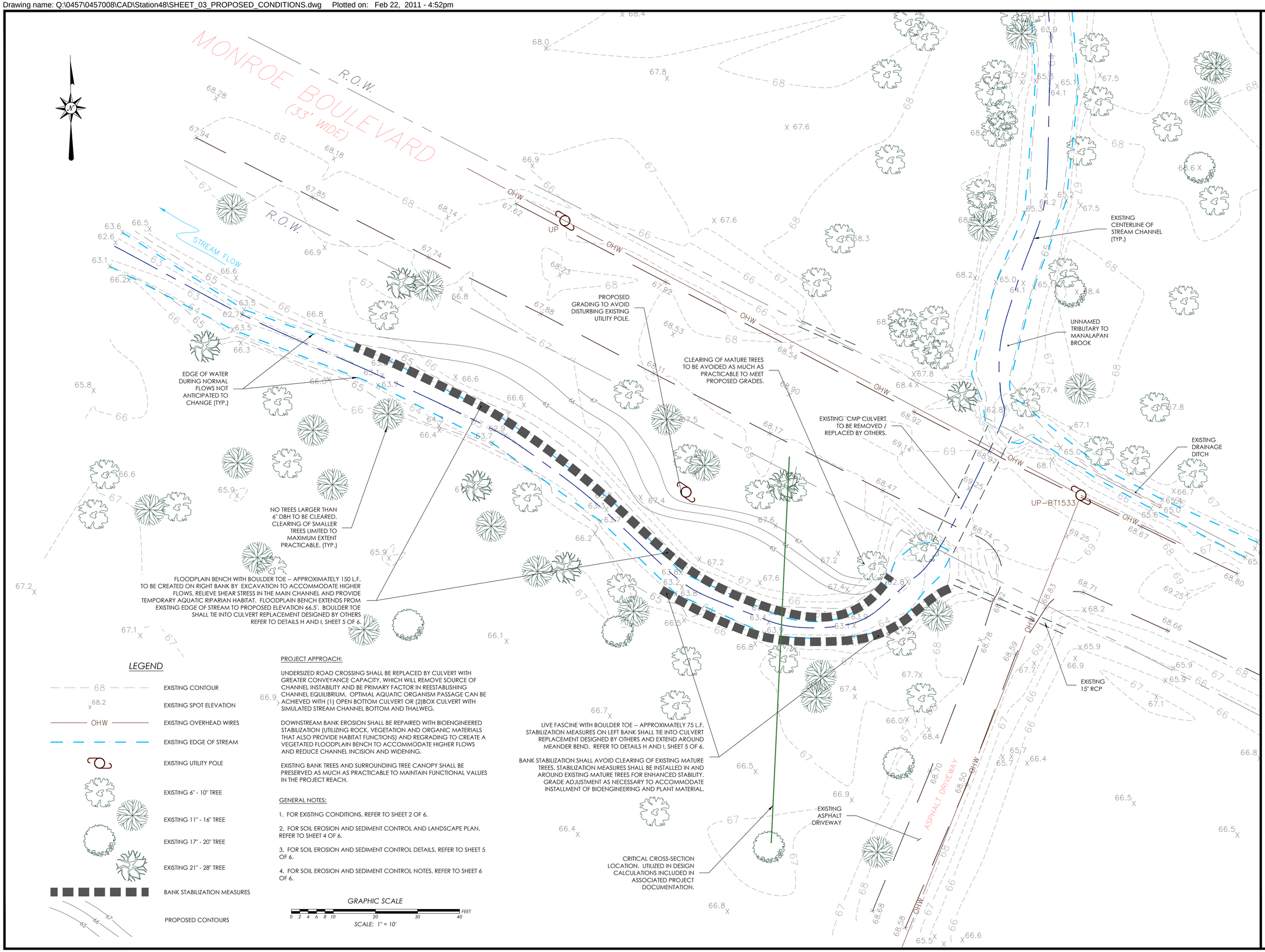
PROJECT NAME/LOCATION:
STREAMBANK STABILIZATION AND FLOODPLAIN RESTORATION -- STATION #48
TOWNSHIP OF MONROE
MIDDLESEX COUNTY, NEW JERSEY

DRAWING NAME:
EXISTING CONDITIONS

DATE:	01/15/2011
PROJECT NO.:	0457.008
SCALE:	AS SHOWN
DRAWN BY:	PW/JH
CHECKED BY:	JH/CE

SHEET NO. 2 OF 6

Drawing name: Q:\0457\0457008\CAD\Station48\SHEET_03_PROPOSED_CONDITIONS.dwg Plotted on: Feb 22, 2011 - 4:52pm



LEGEND

- EXISTING CONTOUR
- EXISTING SPOT ELEVATION
- EXISTING OVERHEAD WIRES
- EXISTING EDGE OF STREAM
- EXISTING UTILITY POLE
- EXISTING 6" - 10" TREE
- EXISTING 11" - 16" TREE
- EXISTING 17" - 20" TREE
- EXISTING 21" - 28" TREE
- BANK STABILIZATION MEASURES
- PROPOSED CONTOURS

PROJECT APPROACH:

UNDERSIZED ROAD CROSSING SHALL BE REPLACED BY CULVERT WITH GREATER CONVEYANCE CAPACITY, WHICH WILL REMOVE SOURCE OF CHANNEL INSTABILITY AND BE PRIMARY FACTOR IN REESTABLISHING CHANNEL EQUILIBRIUM. OPTIMAL AQUATIC ORGANISM PASSAGE CAN BE ACHIEVED WITH (1) OPEN BOTTOM CULVERT OR (2)BOX CULVERT WITH SIMULATED STREAM CHANNEL BOTTOM AND THALWEG.

DOWNSTREAM BANK EROSION SHALL BE REPAIRED WITH BIOENGINEERED STABILIZATION (UTILIZING ROCK, VEGETATION AND ORGANIC MATERIALS THAT ALSO PROVIDE HABITAT FUNCTIONS) AND REGRADING TO CREATE A VEGETATED FLOODPLAIN BENCH TO ACCOMMODATE HIGHER FLOWS AND REDUCE CHANNEL INCISION AND WIDENING.

EXISTING BANK TREES AND SURROUNDING TREE CANOPY SHALL BE PRESERVED AS MUCH AS PRACTICABLE TO MAINTAIN FUNCTIONAL VALUES IN THE PROJECT REACH.

GENERAL NOTES:

1. FOR EXISTING CONDITIONS, REFER TO SHEET 2 OF 6.
2. FOR SOIL EROSION AND SEDIMENT CONTROL AND LANDSCAPE PLAN, REFER TO SHEET 4 OF 6.
3. FOR SOIL EROSION AND SEDIMENT CONTROL DETAILS, REFER TO SHEET 5 OF 6.
4. FOR SOIL EROSION AND SEDIMENT CONTROL NOTES, REFER TO SHEET 6 OF 6.

GRAPHIC SCALE

0 2 4 6 8 10 20 30 40 FEET

SCALE: 1" = 10'

CALL BEFORE YOU DIG!
NEW JERSEY LAW REQUIRES
3 WORKING DAYS NOTICE FOR
CONSTRUCTION PHASE AND 10 WORKING
DAYS IN DESIGN STAGE – STOP CALL
NEW JERSEY ONE CALL SYSTEM, INC.
REFERENCE NEW JERSEY TITLE 48, CHPT. 2, ARTICLE 9
1-800-272-1000

PROJECT NOTES

1. TOPOGRAPHIC SURVEY DATA SHOWN ON THIS PLAN ARE BASED ON FIELD WORK PERFORMED BY J. TIMOTHY KERNAN, INC. FROM NOVEMBER 17, 2010 THRU DECEMBER 9, 2010, OBTAINED IN DIGITAL FORMAT DECEMBER 2010.

2. VERTICAL DATUM IS BASED ON NAVD88, FEET. HORIZONTAL IS BASED ON NAD83, FEET.

3. THE ENTIRE PROJECT AREA IS WITHIN THE 100-YR FLOODPLAIN OF THE MANALAPAN BROOK AS PER THE EFFECTIVE FEMA FLOOD INSURANCE RATE MAP (FIRM), AND THE STATE DELINEATED FLOOD HAZARD AREA (NJFHA). THE ENTIRE PROJECT SITE IS ALSO WITHIN THE 150' RIPARIAN ZONE FOR THE UNNAMED TRIBUTARY TO MANALAPAN BROOK ON WHICH THE PROJECT IS PROPOSED.

4. PROJECT IS LOCATED ENTIRELY WITHIN BLOCK 23, LOT 21.02 (SOUTH OF MONROE BOULEVARD). AUTHORIZATION FROM THE LANDOWNER WILL BE REQUIRED PRIOR TO PERMITTING AND IMPLEMENTATION OF CONSTRUCTION.

5. ADDITIONAL DIGITAL PROPERTY BOUNDARY/EASEMENT INFORMATION WAS NOT AVAILABLE AT THE TIME OF PLAN PREPARATION. THIS INFORMATION WILL BE REQUIRED FOR PERMIT SUBMISSION.

6. NO WETLAND DELINEATION, OR ANY OTHER REGULATORY BOUNDARY DELINEATION HAS BEEN COMPLETED FOR THIS PROJECT AT THE TIME OF PLAN PREPARATION. THIS INFORMATION WILL BE REQUIRED FOR PERMIT SUBMISSION.

7. EXISTING MONROE BOULEVARD CULVERT (IDENTIFIED AS #SC81 BY MIDDLESEX COUNTY) AT THIS LOCATION IS CURRENTLY UNDER DESIGN FOR REPLACEMENT BY DELAWARE RARITAN ENGINEERING. FOR LATEST INFORMATION REGARDING STATUS OF THE CULVERT REPLACEMENT PROJECT, RON SENDNER OF MIDDLESEX COUNTY ENGINEERING DEPARTMENT CAN BE CONTACTED AT (732) 745-3248.

DATE	DESCRIPTION

REVISIONS

STATE OF NEW JERSEY CERTIFICATE OF AUTH. NO.: 24GA27976800

JACOB E. HELMINIAK
Professional Engineer
NJ Lic. No. GE-46967

DATE

PRINCETON HYDRO, LLC
SCIENTISTS AND ENGINEERS
120 EAST UWCHLAN AVENUE
SUITE 204
EXTON, PENNSYLVANIA 19341
PHONE. 610.524.4220
FAX. 610.514.9434
WWW.PRINCETONHYDRO.COM

PROJECT NAME/LOCATION:
STREAMBANK STABILIZATION AND FLOODPLAIN RESTORATION -- STATION #48
TOWNSHIP OF MONROE
MIDDLESEX COUNTY, NEW JERSEY

DRAWING NAME:
PROPOSED CONDITIONS

DATE:	01/15/2011
PROJECT NO.:	0457.008
SCALE:	AS SHOWN
DRAWN BY:	PW/JH
CHECKED BY:	JH/CE

SHEET NO. 3 OF 6

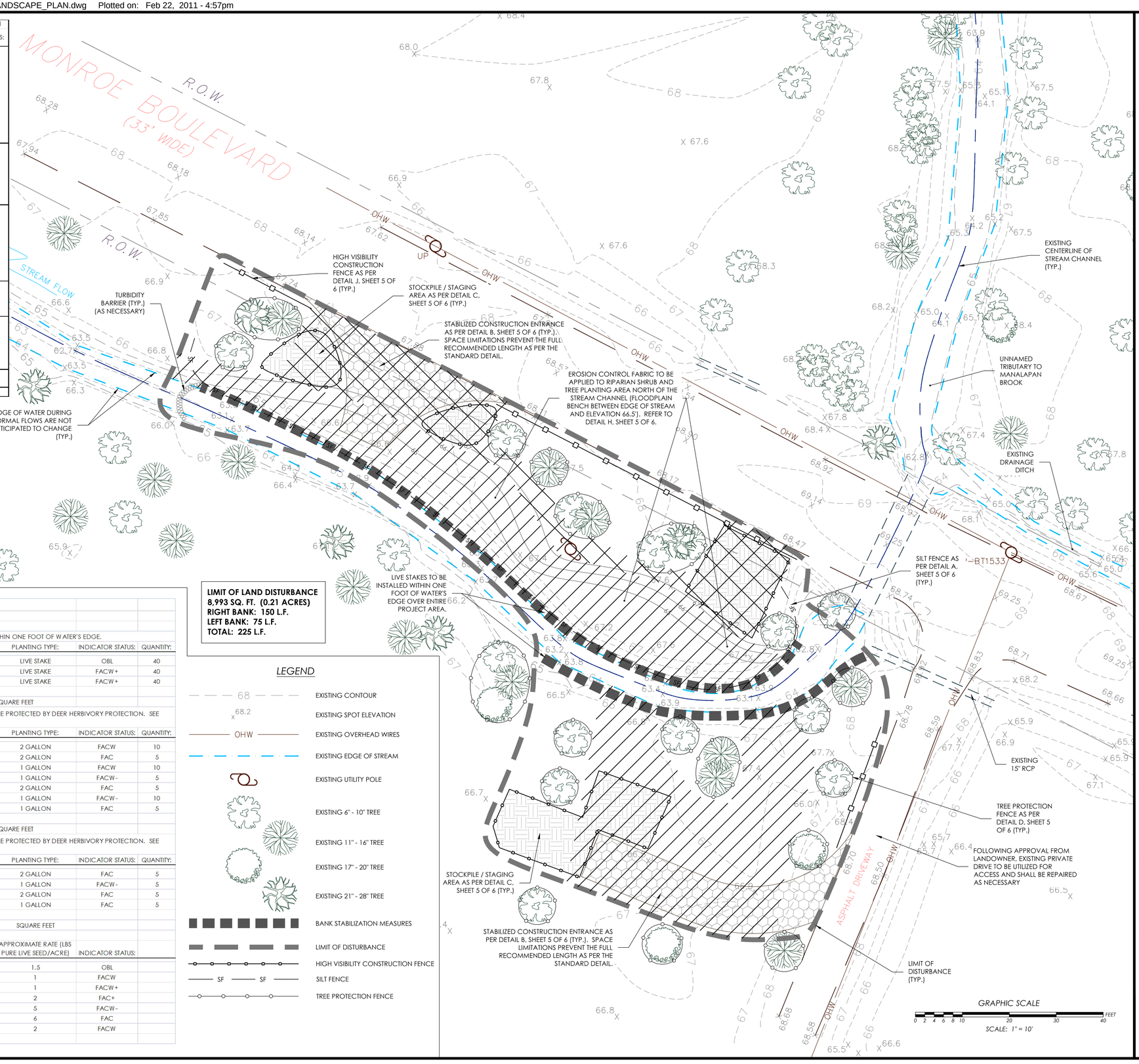
Drawing name: Q:\0457\0457008\CAD\Station48\SHEET_04_SESC_LANDSCAPE_PLAN.dwg Plotted on: Feb 22, 2011 - 4:57pm

	CONSTRUCTION SEQUENCE FOR STREAMBANK STABILIZATION AND FLOODPLAIN CREATION STATION 48	DURATION WORK DAYS:
CONSTRUCTION RESTRICTIONS	1. INSTREAM CONSTRUCTION ACTIVITIES SHALL TAKE NOT TAKE PLACE DURING THE FISH RESTRICTION WINDOW MAY 1 THROUGH JUNE 30. ALL INSTREAM ACTIVITIES SHALL TAKE PLACE IN LOW FLOW CONDITIONS TO MINIMIZE STREAM SEDIMENTATION. ALSO, CUTTING AND CLEARING OF MATURE TRESS SHALL BE MINIMIZED AS MUCH AS PRACTICABLE TO AVOID IMPACTS.	---
SITE PREPARATION	2. INSTALL ALL TEMPORARY EROSION AND SEDIMENTATION CONTROL MEASURES, INCLUDING STABILIZED CONSTRUCTION ACCESS, SILT FENCE, STABILIZED CHANNEL CROSSING, TREE PROTECTION, AND CONSTRUCTION FENCING. CLEAR CONSTRUCTION ACCESS.	2
BANK STABILIZATION	3. FOLLOWING CULVERT REPLACEMENT (DESIGNED BY OTHERS), INSTALL BANK STABILIZATION MEASURES AS PER PLANS ON RIVER LEFT BANK. UTILIZE EXISTING BANK TREES AS ANCHOR POINTS FOR FASCINES AND OTHER MATERIALS. PREPARE SOIL AS PER TOPSOILING NOTES, SHEET 6 OF 6, AND INSTALL PLANTS AS PER LANDSCAPE PLAN.	3
FLOODPLAIN CREATION	4. ON RIVER RIGHT BANK, ROUGH GRADE AREA TO PROPOSED ELEVATIONS. INSTALL STABILIZATION MEASURES AND PLANTS AS PER PLANS.	3
RESTORE SITE	5. PLANT AND RE-SEED REMAINING AREAS AS PER LANDSCAPE PLAN. REGRADE, RESEED AND STABILIZE AS NECESSARY TO RETURN ALL OTHER DISTURBED AREAS TO ORIGINAL PRECONSTRUCTION CONDITIONS.	2
DEMOBILIZATION	6. REMOVE TEMPORARY EROSION AND SEDIMENTATION CONTROL MEASURES.	1
	TOTAL DAYS:	11

MATERIAL QUANTITIES

ITEM	QUANTITY
(01) HIGH VISIBILITY CONSTRUCTION FENCE	170 LF
(02) SILT FENCE	175 LF
(03) STOCKPILE PROTECTION	260 LF
(04) TREE PROTECTION, EXISTING TREES	600 LF
(05) TREE PROTECTION, PROPOSED PLANTS	700 LF
(06) SOIL EXCAVATION AND REMOVAL	150 CY
(07) STONE FOR CONSTRUCTION ENTRANCE	30 CY
(08) STONE FOR BOULDER TOE	25 TONS
(09) LIVE FASCINE	75 LF
(10) EROSION CONTROL FABRIC	2,500 SF
(11) TEMPORARY STABILIZATION SEED MIX	42 LBS

REFER TO SHEET 3 OF 6 (PROPOSED CONDITIONS), AND SHEET 5 OF 6 (DETAILS) FOR ADDITIONAL INFORMATION ON LOCATION OF BANK STABILIZATION MEASURES.



LIMIT OF LAND DISTURBANCE
8,993 SQ. FT. (0.21 ACRES)
RIGHT BANK: 150 L.F.
LEFT BANK: 75 L.F.
TOTAL: 225 L.F.

PLANT LIST AND KEY

LIVE STAKES

SPACED TWO (2) FEET ON CENTER SCATTERED IRREGULARLY WITHIN ONE FOOT OF WATER'S EDGE.

BOTANICAL NAME	SPECIES NAME	PLANTING TYPE:	INDICATOR STATUS:	QUANTITY:
CEPHALANTHUS OCCIDENTALIS	BUTTONBUSH	LIVE STAKE	OBL	40
CORNUS SERICEA	RED OSIER DOGWOOD	LIVE STAKE	FACW+	40
SALIX NIGRA	BLACK WILLOW	LIVE STAKE	FACW+	40

RIPARIAN SHRUBS AND TREES 3,710 SQUARE FEET

SPACED EIGHT (8) FEET ON CENTER. ALL TREES AND SHRUBS TO BE PROTECTED BY DEER HERBIVORY PROTECTION. SEE DETAIL G ON SHEET 5 OF 6.

BOTANICAL NAME	SPECIES NAME	PLANTING TYPE:	INDICATOR STATUS:	QUANTITY:
ACER SACCHARINUM	SILVER MAPLE	2 GALLON	FACW	10
BETULA POPULIFOLIA	GRAY BIRCH	2 GALLON	FAC	5
CORNUS AMOMUM	SILKY DOGWOOD	1 GALLON	FACW	10
LINDERA BENZOIN	SPICEBUSH	1 GALLON	FACW-	5
LIQUIDAMBAR STYRACIFLUA	SWEETGUM	2 GALLON	FAC	5
PHYSOCARPUS OPULIFOLIUS	COMMON NINEBARK	1 GALLON	FACW-	10
VIBURNUM DENTATUM	ARROWWOOD VIBURNUM	1 GALLON	FAC	5

UPLAND SHRUBS AND TREES 1,290 SQUARE FEET

SPACED EIGHT (8) FEET ON CENTER. ALL TREES AND SHRUBS TO BE PROTECTED BY DEER HERBIVORY PROTECTION. SEE DETAIL G ON SHEET 5 OF 6.

BOTANICAL NAME	SPECIES NAME	PLANTING TYPE:	INDICATOR STATUS:	QUANTITY:
BETULA POPULIFOLIA	GRAY BIRCH	2 GALLON	FAC	5
LINDERA BENZOIN	SPICEBUSH	1 GALLON	FACW-	5
LIQUIDAMBAR STYRACIFLUA	SWEETGUM	2 GALLON	FAC	5
VIBURNUM DENTATUM	ARROWWOOD VIBURNUM	1 GALLON	FAC	5

RIPARIAN SEED 8,000 SQUARE FEET

TO BE SOWN OVER ALL DISTURBED AREAS.

BOTANICAL NAME	SPECIES NAME	APPROXIMATE RATE (LBS PURE LIVE SEED/ACRE)	INDICATOR STATUS:
CAREX VULPINOIDEA	FOX SEDGE	1.5	OBL
ELYMUS RIPARIUS	RIVERBANK WILD RYE	1	FACW
JUNCUS EFFUSUS	SOFT RUSH	1	FACW+
PANICUM CLANDESTINUM	DEER TONGUE	2	FAC+
PANICUM DICHOTOMIFLORUM	SMOOTH PANIC GRASS	5	FACW-
PANICUM VIRGATUM	PANICGRASS	6	FAC
POLYGONUM PENSYLVANICUM	PENNSYLVANIA SMARTWEED	2	FACW

LEGEND

- EXISTING CONTOUR
- EXISTING SPOT ELEVATION
- EXISTING OVERHEAD WIRES
- EXISTING EDGE OF STREAM
- EXISTING UTILITY POLE
- EXISTING 6" - 10" TREE
- EXISTING 11" - 16" TREE
- EXISTING 17" - 20" TREE
- EXISTING 21" - 28" TREE
- BANK STABILIZATION MEASURES
- LIMIT OF DISTURBANCE
- HIGH VISIBILITY CONSTRUCTION FENCE
- SILT FENCE
- TREE PROTECTION FENCE

CALL BEFORE YOU DIG!
NEW JERSEY LAW REQUIRES
3 WORKING DAYS NOTICE FOR
CONSTRUCTION PHASE AND 10 WORKING
DAYS IN DESIGN STAGE – STOP CALL
NEW JERSEY ONE CALL SYSTEM, INC.
REFERENCE NEW JERSEY TITLE 48, CHPT. 2, ARTICLE 9
1-800-272-1000

PROJECT NOTES

1. TOPOGRAPHIC SURVEY DATA SHOWN ON THIS PLAN ARE BASED ON FIELD WORK PERFORMED BY J. TIMOTHY KERNAN, INC. FROM NOVEMBER 17, 2010 THRU DECEMBER 9, 2010. OBTAINED IN DIGITAL FORMAT DECEMBER 2010.

2. VERTICAL DATUM IS BASED ON NAVD88. FEET. HORIZONTAL IS BASED ON NAD83. FEET.

3. THE ENTIRE PROJECT AREA IS WITHIN THE 100-YR FLOODPLAIN OF THE MANALAPAN BROOK AS PER THE EFFECTIVE FEMA FLOOD INSURANCE RATE MAP (FIRM). AND THE STATE DELINEATED FLOOD HAZARD AREA (NJFHA). THE ENTIRE PROJECT SITE IS ALSO WITHIN THE 150' RIPARIAN ZONE FOR THE UNNAMED TRIBUTARY TO MANALAPAN BROOK ON WHICH THE PROJECT IS PROPOSED.

4. PROJECT IS LOCATED ENTIRELY WITHIN BLOCK 23, LOT 21.02 (SOUTH OF MONROE BOULEVARD). AUTHORIZATION FROM THE LANDOWNER WILL BE REQUIRED PRIOR TO PERMITTING AND IMPLEMENTATION OF CONSTRUCTION.

5. ADDITIONAL DIGITAL PROPERTY BOUNDARY/EASEMENT INFORMATION WAS NOT AVAILABLE AT THE TIME OF PLAN PREPARATION. THIS INFORMATION WILL BE REQUIRED FOR PERMIT SUBMISSION.

6. NO WETLAND DELINEATION, OR ANY OTHER REGULATORY BOUNDARY DELINEATION HAS BEEN COMPLETED FOR THIS PROJECT AT THE TIME OF PLAN PREPARATION. THIS INFORMATION WILL BE REQUIRED FOR PERMIT SUBMISSION.

7. EXISTING MONROE BOULEVARD CULVERT (IDENTIFIED AS #5C81 BY MIDDLESEX COUNTY) AT THIS LOCATION IS CURRENTLY UNDER DESIGN FOR REPLACEMENT BY DELAWARE RARITAN ENGINEERING. FOR LATEST INFORMATION REGARDING STATUS OF THE CULVERT REPLACEMENT PROJECT, RON SENDNER OF MIDDLESEX COUNTY ENGINEERING DEPARTMENT CAN BE CONTACTED AT (732) 745-3248.

DATE	DESCRIPTION

REVISIONS

STATE OF NEW JERSEY CERTIFICATE OF AUTH. NO.: 24GA27976800

JACOB E. HELMINIAK
Professional Engineer
NJ Lic. No. GE-46967

DATE

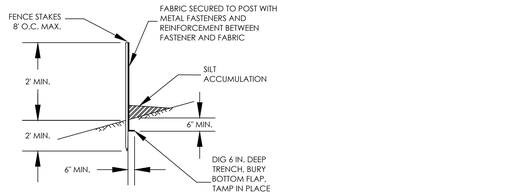
PRINCETON HYDRO, LLC
SCIENTISTS AND ENGINEERS
120 EAST UWCHLAN AVENUE
SUITE 204
EXTON, PENNSYLVANIA 19341
PHONE. 610.524.4220
FAX. 610.514.9434
WWW.PRINCETONHYDRO.COM

PROJECT NAME/LOCATION:
STREAMBANK STABILIZATION AND FLOODPLAIN RESTORATION -- STATION #48
TOWNSHIP OF MONROE
MIDDLESEX COUNTY, NEW JERSEY

DRAWING NAME:
SOIL EROSION AND SEDIMENT CONTROL AND LANDSCAPE PLAN

DATE:	01/15/2011
PROJECT NO.:	0457.008
SCALE:	AS SHOWN
DRAWN BY:	LK
CHECKED BY:	JH/CE

SHEET NO. 4 OF 6



NOTES:

1. FENCE POSTS SHALL BE SPACED 8 FEET CENTER TO CENTER OR CLOSER. THE POSTS SHALL EXTEND AT LEAST 2 FEET INTO THE GROUND AND EXTEND AT LEAST 2 FEET ABOVE THE GROUND AND SHALL BE CONSTRUCTED OF HARDWOOD WITH A MINIMUM DIAMETER THICKNESS OF 1.5 INCHES.

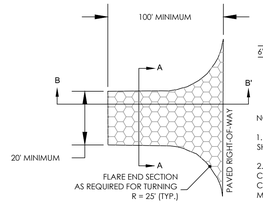
2. A METAL FENCE WITH 6 INCH OR SMALLER OPENINGS AND AT LEAST 2 FEET HIGH MAY BE UTILIZED, FASTENED TO THE FENCE POSTS, TO PROVIDE REINFORCEMENT AND SUPPORT TO THE GEOTEXTILE FABRIC WHERE SPACE FOR OTHER PRACTICES IS LIMITED AND HEAVY SEDIMENT LOADING IS EXPECTED.

3. A GEOTEXTILE FABRIC, RECOMMENDED FOR SUCH USE BY THE MANUFACTURER, SHALL BE BURIED AT LEAST 6 INCHES DEEP IN THE GROUND. THE FABRIC SHALL EXTEND AT LEAST 2 FEET ABOVE THE GROUND. FABRIC MUST BE SECURELY FASTENED TO THE POSTS USING A SYSTEM CONSISTING OF METAL FASTENERS (NAILS OR STAPLES) AND HIGH STRENGTH REINFORCEMENT MATERIAL (NYLON WEBBING, GROMMETS, WASHERS, ETC.) PLACED BETWEEN THE FASTENER AND THE GEOTEXTILE FABRIC. THE FASTENING SYSTEM SHALL RESIST TEARING AWAY FROM THE POST. THE FABRIC SHALL INCORPORATE A DRAWSTRING IN THE TOP PORTION OF THE FENCE FOR ADDED STRENGTH.

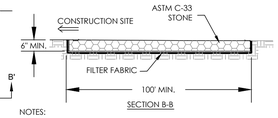
4. SEDIMENTS SHALL BE REMOVED WHEN THE ACCUMULATION HEIGHT REACHES ONE QUARTER THE GROUND HEIGHT OF THE FENCE.

5. SILT FENCE SHALL BE PLACED DOWNSLOPE OF ALL CONSTRUCTION ACCESS ROADS.

A SILT FENCE DETAIL
NOT TO SCALE



SECTION A-A



SECTION B-B

NOTES:

1. STABILIZED CONSTRUCTION ENTRANCE WILL BE CONSTRUCTED AS SHOWN ON THE DETAIL.

2. STONE SIZE - ASTM C-33, SIZE NO. 2 OR 3. THE STONE SHALL CONSIST OF CLEAN CRUSHED ANGULAR PARTICLES. RECYCLED CONCRETE OF SIMILAR SIZE MAY BE SUBSTITUTED BUT WILL REQUIRE MORE FREQUENT UPGRADING AND MAINTENANCE.

2. A GEOTEXTILE FABRIC UNDERLAYMENT, OR A TYPE RECOMMENDED FOR SUCH APPLICATIONS BY THE MANUFACTURER WILL BE USED WITHOUT REGARD TO SOIL TYPE.

3. THE STRUCTURE'S THICKNESS WILL BE CONSTANTLY MAINTAINED AT THE SPECIFIED DIMENSIONS BY ADDING ROCK WHEN NECESSARY.

4. ALL SEDIMENT SPILLED, DROPPED, WASHED, OR TRACKED ONTO PUBLIC RIGHTS-OF-WAY MUST BE REMOVED IMMEDIATELY.

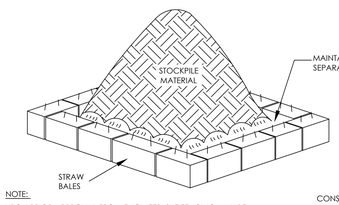
5. RUNOFF FROM STREETS SHALL BE DIVERTED FROM STABILIZED CONSTRUCTION ENTRANCES. THIS MAY BE ACCOMPLISHED USING PRECAST SPEED BUMPS.

6. CONSTRUCTION ENTRANCE SHALL BE REMOVED UPON PROJECT COMPLETION.

PERCENT SLOPE OF ROADWAY	LENGTH OF STONE REQUIRED	
	COARSE GRAINED SOILS	FINE GRAINED SOILS
0 TO 2%	50 FT	100 FT
2 TO 5%	100 FT	200 FT
>5%	ENTIRE SURFACE STABILIZED WITH FABC BASE COURSE **	

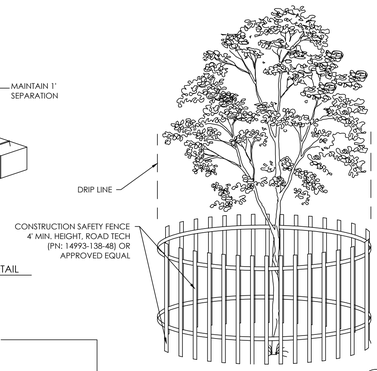
** AS PRESCRIBED BY LOCAL ORDINANCE OR OTHER GOVERNING AUTHORITY.

B STABILIZED CONSTRUCTION ENTRANCE
NOT TO SCALE



NOTE:
UPON PRIOR APPROVAL FROM ENGINEER: SILT FENCING MAY BE SUBSTITUTED FOR STRAW BALES, AND TEMPORARY SEEDING OF STOCKPILES MAY BE SUBSTITUTED FOR PLASTIC COVERING.

C STOCKPILE CONTROL DETAIL
NOT TO SCALE



NOTES:

1. TO PREVENT GENERAL MECHANICAL DAMAGE TO TREES INSTALL TREE PROTECTION AS INDICATED IN DETAIL.

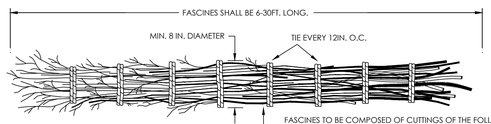
2. BOX TREES WITHIN 25 FEET OF BUILDINGS SITE TO PREVENT MECHANICAL INJURY, FENCING OR OTHER BARRIER SHOULD BE INSTALLED AT THE DRIP LINE OF THE TREE BRANCHES OR BEYOND. TREE ROOT SYSTEMS COMMONLY EXTEND WELL BEYOND THE DRIP LINE.

3. BOARDS WILL NOT BE NAILED TO TREES DURING CONSTRUCTION.

4. FEEDER ROOTS SHOULD NOT BE CUT IN AN AREA INSIDE THE DRIP LINE OF THE TREE BRANCHES

5. DAMAGED TRUNKS OR EXPOSED ROOTS SHOULD HAVE DAMAGED BARK REMOVED IMMEDIATELY AND NO PAINT SHALL BE APPLIED. EXPOSED ROOTS SHOULD BE COVERED WITH TOPSOIL IMMEDIATELY AFTER EXCAVATION IS COMPLETE. ROOTS SHALL BE PRUNED TO GIVE A CLEAN, SHARP SURFACE AMENABLE TO HEALING. ROOTS EXPOSED DURING HOT WEATHER SHOULD BE IRRIGATED TO PREVENT PERMANENT TREE INJURY. CARE FOR SERIOUS INJURY SHOULD BE PRESCRIBED BY A PROFESSIONAL FORESTER OR CERTIFIED TREE EXPERT.

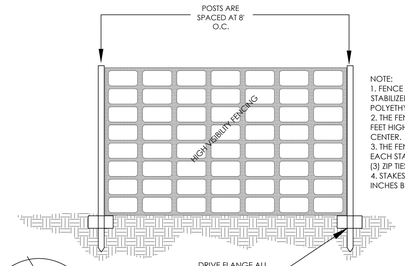
D TREE PROTECTION DETAIL
NOT TO SCALE



FASCINES TO BE COMPOSED OF CUTTINGS OF THE FOLLOWING SPECIES:

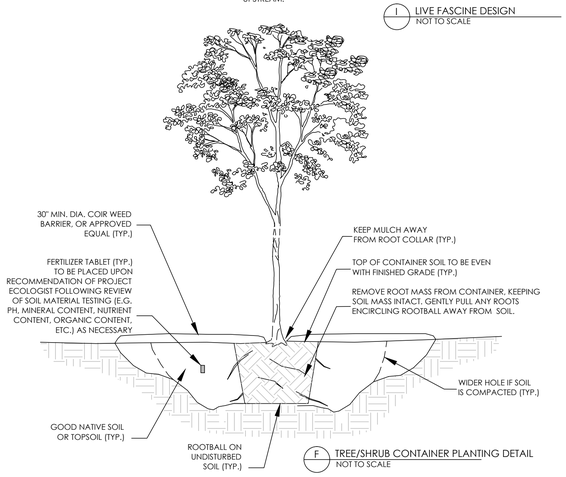
BOTANICAL NAME	SPECIES NAME
CEPHALANTHUS OCCIDENTALIS	BUTTONBUSH
CORNUS SERICEA	RED OSIER DOGWOOD
SALIX NIGRA	BLACK WILLOW

I LIVE FASCINE DESIGN
NOT TO SCALE

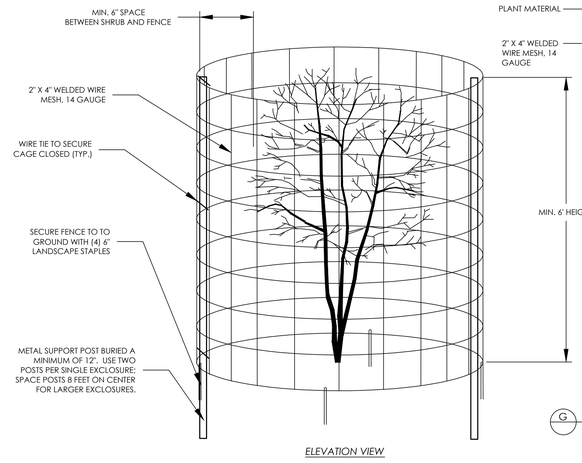


NOTE:
1. FENCE SHALL BE CONSTRUCTED OF UV STABILIZED HIGH VISIBILITY ORANGE POLYETHYLENE SAFETY FENCE.
2. THE FENCE SHALL BE A MINIMUM OF 4 FEET HIGH AND STAKED AT 8 FOOT ON CENTER.
3. THE FENCE SHALL BE ATTACHED TO EACH STAKE WITH A MINIMUM OF THREE (3) ZIP TIES OR APPROVED EQUAL.
4. STAKES SHOULD BE DRIVE 6 TO 12 INCHES BELOW GRADE.

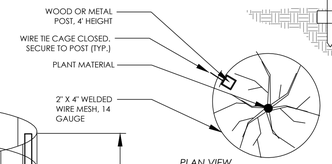
J HIGH VISIBILITY FENCE
NOT TO SCALE



F TREE/SHRUB CONTAINER PLANTING DETAIL
NOT TO SCALE



ELEVATION VIEW



PLAN VIEW

NOTES:

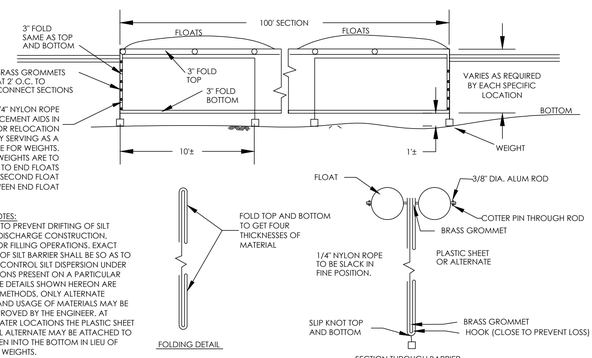
1. TO PREVENT DEER BROWSING, INSTALL PLANT CAGES AS INDICATED IN DETAIL.

2. WHERE POSSIBLE, SURROUND CLOSELY GROUPED PLANTS WITH A SINGLE LENGTH OF FENCE.

3. SECURE PLANT CAGE TO GROUND WITH A MINIMUM OF TWO LANDSCAPE STAPLES, MINIMUM ONE STAPLE EVERY FIVE FEET FOR LARGE MULTI-PLANT ENCLOSURES.

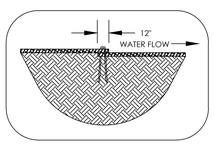
4. USE (3) WIRE TIES TO FASTEN WIRE FENCE CLOSED.

G DEER HERBIVORY PROTECTION DETAIL
NOT TO SCALE



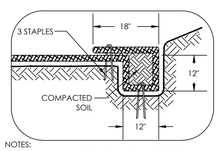
GENERAL NOTES:
SILT BARRIER TO PREVENT DRIFTING OF SILT CAUSED BY DISCHARGE CONSTRUCTION, DREDGING OR FILLING OPERATIONS. EXACT PLACEMENT OF SILT BARRIER SHALL BE SO AS TO EFFECTIVELY CONTROL SILT DISPERSION UNDER THE CONDITIONS PRESENT ON A PARTICULAR PROJECT. THE DETAILS SHOWN HEREON ARE SUGGESTED METHODS. ONLY ALTERNATE SOLUTIONS AND USAGE OF MATERIALS MAY BE USED AS APPROVED BY THE ENGINEER. AT SHALLOW WATER LOCATIONS THE PLASTIC SHEET OR MATERIAL ALTERNATE MAY BE ATTACHED TO STAKES DRIVEN INTO THE BOTTOM IN LIEU OF FLOATS AND WEIGHTS.

L TURBIDITY BARRIER DETAIL
NOT TO SCALE
ONLY AS NECESSARY



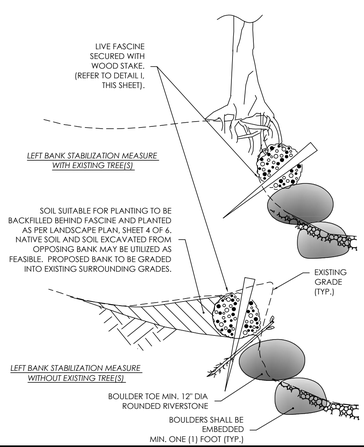
NOTES:
1. EDGE OVERLAP SHALL BE 12" (MIN.) STAPLE THROUGH BOTH PLIES WITH STAPLES DRIVEN FLUSH WITH SOIL SURFACE.
2. WHEN BLANKETS MUST BE SPLICED DOWN THE SLOPE, PLACE BLANKETS END OVER END (SHINGLE STYLE), WITH 24" MIN. OVERLAP. STAPLE THROUGH OVERLAPPED AREA APPROXIMATELY 12" APART.

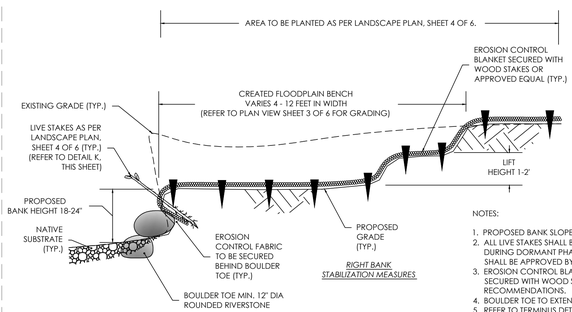
EROSION CONTROL FABRIC EDGE AND JUNCTION OVERLAP



NOTES:
EXTEND THE BLANKET 2'-3' OVER CREST OF SLOPE AND EXCAVATE 12" DEEP X 12" WIDE TERMINAL TRENCH

EROSION CONTROL FABRIC TERMINUS DETAIL

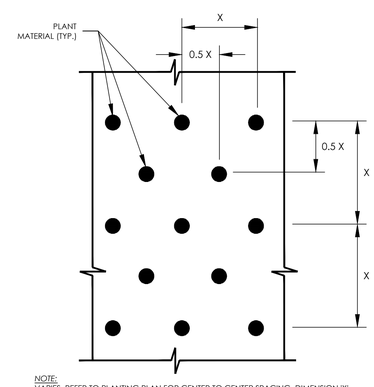




RIGHT BANK STABILIZATION MEASURES

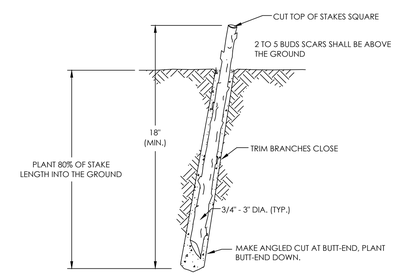
NOTES:
1. PROPOSED BANK SLOPES SHALL BE NO STEEPER THAN 3H:1V.
2. ALL LIVE STAKES SHALL BE INSTALLED WHILE DORMANT. IF CONSTRUCTION DOES NOT OCCUR DURING DORMANT PHASE (NOVEMBER THROUGH FEBRUARY), ALTERNATIVE PLANTING MATERIAL SHALL BE APPROVED BY PROJECT ENGINEER PRIOR TO IMPLEMENTATION.
3. EROSION CONTROL BLANKET SHALL BE LANDLOK ® CS2, OR APPROVED EQUAL, AND SHALL BE SECURED WITH WOOD STAKES, STAPLES, OR APPROVED EQUAL, AS PER MANUFACTURERS RECOMMENDATIONS.
4. BOULDER TOE TO EXTEND MINIMUM 12" BELOW EXISTING CHANNEL BED.
5. REFER TO TERMINUS DETAIL AND EDGE AND JUNCTION OVERLAP FOR PROPER PLACEMENT OF EROSION CONTROL FABRIC.

H STREAM CORRIDOR CROSS SECTION
NOT TO SCALE
LOOKING DOWNSTREAM



NOTE:
VARIES, REFER TO PLANTING PLAN FOR CENTER TO CENTER SPACING, DIMENSION 'X'.

E PLANT MATERIAL SPACING DETAIL
C.C. SPACING PLAN
NOT TO SCALE



CROSS-SECTIONAL VIEW

NOTES:
1. HARVEST AND PLANT STAKES DURING THE DORMANT SEASON.
2. USE HEALTHY, STRAIGHT AND LIVE WOOD AT LEAST 1 YEAR OLD. ALL STAKES SHALL BE OF SUFFICIENT LENGTH TO REACH APPROXIMATE GROUNDWATER ELEVATION.
3. MAKE CLEAN CUTS AND DO NOT DAMAGE STAKES OR SPLIT ENDS DURING INSTALLATION; USE AN IRON BAR AND PILOT HOLE IN FIRM SOILS.
4. SOAK CUTTINGS FOR AT LEAST 24 HOURS PRIOR TO INSTALLATION. SOAK FOR 5-7 DAYS FOR BEST RESULTS.
5. TAMP THE SOIL AROUND THE STAKE.

K LIVE STAKING DETAIL
NOT TO SCALE

CALL BEFORE YOU DIG!
NEW JERSEY LAW REQUIRES 3 WORKING DAYS NOTICE FOR CONSTRUCTION PHASE AND 10 WORKING DAYS IN DESIGN STAGE – STOP CALL
NEW JERSEY ONE CALL SYSTEM, INC.
REFERENCE NEW JERSEY TITLE 48, CHPT. 2, ARTICLE 9
1-800-272-1000

PROJECT NOTES

1. TOPOGRAPHIC SURVEY DATA SHOWN ON THIS PLAN ARE BASED ON FIELD WORK PERFORMED BY J. TIMOTHY KERNAN, INC. FROM NOVEMBER 17, 2010 THRU DECEMBER 9, 2010, OBTAINED IN DIGITAL FORMAT DECEMBER 2010.

2. VERTICAL DATUM IS BASED ON NAVD88, FEET. HORIZONTAL IS BASED ON NAD83, FEET.

3. THE ENTIRE PROJECT AREA IS WITHIN THE 100-YR FLOODPLAIN OF THE MANALAPAN BROOK AS PER THE EFFECTIVE FEMA FLOOD INSURANCE RATE MAP (FIRM). AND THE STATE DELINEATED FLOOD HAZARD AREA (NJFHA). THE ENTIRE PROJECT SITE IS ALSO WITHIN THE 150' RIPARIAN ZONE FOR THE UNNAMED TRIBUTARY TO MANALAPAN BROOK ON WHICH THE PROJECT IS PROPOSED.

4. PROJECT IS LOCATED ENTIRELY WITHIN BLOCK 23, LOT 21.02 (SOUTH OF MONROE BOULEVARD). AUTHORIZATION FROM THE LANDOWNER WILL BE REQUIRED PRIOR TO PERMITTING AND IMPLEMENTATION OF CONSTRUCTION.

5. ADDITIONAL DIGITAL PROPERTY BOUNDARY/EASEMENT INFORMATION WAS NOT AVAILABLE AT THE TIME OF PLAN PREPARATION. THIS INFORMATION WILL BE REQUIRED FOR PERMIT SUBMISSION.

6. NO WETLAND DELINEATION, OR ANY OTHER REGULATORY BOUNDARY DELINEATION HAS BEEN COMPLETED FOR THIS PROJECT AT THE TIME OF PLAN PREPARATION. THIS INFORMATION WILL BE REQUIRED FOR PERMIT SUBMISSION.

7. EXISTING MONROE BOULEVARD CULVERT (IDENTIFIED AS #SCB1 BY MIDDLESEX COUNTY) AT THIS LOCATION IS CURRENTLY UNDER DESIGN FOR REPLACEMENT BY DELAWARE RARITAN ENGINEERING. FOR LATEST INFORMATION REGARDING STATUS OF THE CULVERT REPLACEMENT PROJECT, RON SENDNER OF MIDDLESEX COUNTY ENGINEERING DEPARTMENT CAN BE CONTACTED AT (732) 745-3248.

DATE	DESCRIPTION

REVISIONS

STATE OF NEW JERSEY CERTIFICATE OF AUTH. NO.: 24GA27976800

JACOB E. HELMINIAK
Professional Engineer
NJ Lic. No. GE-46967

DATE

PRINCETON HYDRO, LLC
SCIENTISTS AND ENGINEERS
120 EAST UWCHLAN AVENUE
SUITE 204
EXTON, PENNSYLVANIA 19341
PHONE. 610.524.4220
FAX. 610.514.9434
WWW.PRINCETONHYDRO.COM

PROJECT NAME/LOCATION:
STREAMBANK STABILIZATION AND FLOODPLAIN RESTORATION -- STATION #48
TOWNSHIP OF MONROE
MIDDLESEX COUNTY, NEW JERSEY

DRAWING NAME:
SOIL EROSION AND SEDIMENT CONTROL AND CONSTRUCTION DETAILS

DATE:	01/15/2011
PROJECT NO.:	0457.008
SCALE:	AS SHOWN
DRAWN BY:	PW/JH
CHECKED BY:	JH/CE

SHEET NO. 5 OF 6

Drawing name: Q:\0457\0457008\CAD\Station48\SHEET_06_NOTES.dwg   Plotted on: Feb 22, 2011 - 4:56pm

STANDARD FOR TOPSOILING

DEFINITION:

TOPSOILING ENTAILS THE DISTRIBUTION OF SUITABLE QUALITY SOIL ON AREAS TO BE VEGETATED.

PURPOSE:

TO IMPROVE THE SOIL MEDIUM FOR PLANT ESTABLISHMENT AND MAINTENANCE.

WATER QUALITY ENHANCEMENT:

GROWTH AND ESTABLISHMENT OF A VIGOROUS VEGETATIVE COVER IS FACILITATED BY TOPSOIL, PREVENTING SOIL LOSS BY WIND AND RAIN OFFSITE AND INTO STREAMS AND OTHER STORMWATER CONVEYANCE.

WHERE APPLICABLE:

TOPSOIL SHALL BE USED WHERE SOILS ARE TO BE DISTURBED AND WILL BE REVEGETATED.

METHODS AND MATERIALS:

1. MATERIALS

A. TOPSOIL SHOULD BE FRIABLE , LOAMY , FREE OF DEBRIS, OBJECTIONABLE WEEDS, STONES, AND CONTAIN NO TOXIC SUBSTANCE OR ADVERSE CHEMICAL OR PHYSICAL CONDITION THAT MAY BE HARMFUL TO PLANT GROWTH. SOLUBLE SALTS SHOULD NOT BE EXCESSIVE (CONDUCTIVITY LESS THAN 0.5 MILLIOHMS PER CENTIMETER. MORE THAN 0.5 MILLIOHMS MAY DESICCATE SEEDLINGS AND ADVERSELY IMPACT GROWTH.) TOPSOIL HAULED IN FROM OFFSITE SHOULD HAVE A MINIMUM ORGANIC MATTER CONTENT OF 2.75 PERCENT. ORGANIC MATTER CONTENTS MAY BE RAISED BY ADDITIVES.

B. TOPSOIL SUBSTITUTE IS A SOIL MATERIAL WHICH MAY HAVE BEEN AMENDED WITH SAND, SILT, CLAY, ORGANIC MATTER, FERTILIZER OR LIME AND HAS THE APPEARANCE OF TOPSOIL. TOPSOIL SUBSTITUTES MAP BE UTILIZED ON SITES WITH INSUFFICIENT TOPSOIL FOR ESTABLISHING PERMANENT VEGETATION. ALL TOPSOIL SUBSTITUTE MATERIALS SHALL MEET THE REQUIREMENT OF TOPSOIL NOTED ABOVE. SOIL TESTS SHALL BE PERFORMED TO DETERMINE THE COMPONENTS OF SAND, SILT, CLAY, ORGANIC MATTER, SOLUBLE SALTS AND pH LEVEL.

2. STRIPPING AND STOCKPILING

A. FIELD EXPLORATION SHOULD BE MADE TO DETERMINE WHETHER QUANTITY AND OR QUALITY OF SURFACE SOIL JUSTIFIES STRIPPING.

B. STRIPPING SHOULD BE CONFINED TO THE IMMEDIATE CONSTRUCTION AREA.

C. WHERE FEASIBLE, LIME MAY BE APPLIED BEFORE STRIPPING AT A RATE DETERMINED BY SOIL TESTS TO BRING THE SOIL pH TO APPROXIMATELY 6.5. IN LIEU OF SOIL TESTS, SEE LIME RATE GUIDE IN SEEDBED PREPARATION FOR PERMANENT VEGETATIVE COVER FOR SOIL STABILIZATION, SEE TABLE 7-1.

D. A 4-6 INCH STRIPPING DEPTH IS COMMON, BUT MAY VARY DEPENDING ON THE PARTICULAR SOIL.

E. STOCKPILES OF TOPSOIL SHOULD BE SITUATED SO AS NOT TO OBSTRUCT NATURAL DRAINAGE OR CAUSE OFF-SITE ENVIRONMENTAL DAMAGE.

F. STOCKPILES SHOULD BE VEGETATED IN ACCORDANCE WITH STANDARDS PREVIOUSLY DESCRIBED HEREIN; SEE STANDARDS FOR PERMANENT OR TEMPORARY VEGETATIVE COVER FOR SOIL STABILIZATION ("STANDARDS FOR SOIL EROSION AND SEDIMENT CONTROL IN NEW JERSEY", THE NEW JERSEY STATE SOIL CONSERVATION COMMITTEE, JULY 1999"). WEEDS SHOULD NOT BE ALLOWED TO GROW ON STOCKPILES.

3. SITE PREPARATION

A. GRADE AT THE ONSET OF THE OPTIMAL SEEDING PERIOD SO AS TO MINIMIZE THE DURATION AND AREA OF EXPOSURE OF DISTURBED SOIL TO EROSION. IMMEDIATELY PROCEED TO ESTABLISH VEGETATIVE COVER IN ACCORDANCE WITH THE SPECIFIED SEED MIXTURE. TIME IS OF THE ESSENCE.

B. GRADE AS NEEDED AND FEASIBLE TO PERMIT THE USE OF CONVENTIONAL EQUIPMENT FOR SEEDBED PREPARATION, SEEDING, MULCH APPLICATION AND ANCHORING, AND MAINTENANCE. SEE STANDARD FOR LAND GRADING. ("STANDARDS FOR SOIL EROSION AND SEDIMENT CONTROL IN NEW JERSEY", NEW JERSEY STATE SOIL CONSERVATION COMMITTEE, JULY 1999, PAGE 19-1)

C. AS GUIDANCE FOR IDEAL CONDITIONS, SUBSOIL SHOULD BE TESTED FOR LIME REQUIREMENT. LIMESTONE, IF NEEDED, SHOULD BE APPLIED TO BRING SOIL pH OF APPROXIMATELY 6.5 AND INCORPORATED INTO THE SOIL AS NEARLY AS PARTICLE TO A DEPTH OF 4 INCHES.

D. IMMEDIATELY PRIOR TO TOPSOILING, THE SURFACE SHOULD BE SCARIFIED 6 TO 12 INCHES WHERE THERE HAS BEEN SOIL COMPACTION. THIS WILL HELP INSURE A GOOD BOND BETWEEN THE TOPSOIL AND SUBSOIL. ***THIS PRACTICE IS PERMISSIBLE ONLY WHERE THERE IS NO DANGER TO UNDERGROUND UTILITIES (CABLES, IRRIGATION SYSTEMS, ETC.)***

E. EMPLOY NEEDED EROSION CONTROL PRACTICES SUCH AS DIVERSIONS, GRADE STABILIZATION STRUCTURES, CHANNEL STABILIZATION MEASURES, SEDIMENTATION BASINS, AND WATERWAYS. SEE STANDARDS 11 THROUGH 42, "STANDARDS FOR SOIL EROSION AND SEDIMENT CONTROL IN NEW JERSEY", THE NEW JERSEY STATE SOIL CONSERVATION COMMITTEE, JULY 1999.

4. APPLYING TOPSOIL

A. TOPSOIL SHOULD BE HANDLED ONLY WHEN IT IS DRY ENOUGH TO WORK WITHOUT DAMAGING SOIL STRUCTURES; I.E. LESS THAN FIELD CAPACITY (SEE GLOSSARY,"STANDARDS FOR SOIL EROSION AND SEDIMENT CONTROL IN NEW JERSEY", THE NEW JERSEY STATE SOIL CONSERVATION COMMITTEE, JULY 1999).

B. A UNIFORM APPLICATION TO A DEPTH OF 5 INCHES (UNSETTLED) IS RECOMMENDED. SOILS WITH A pH OF 4.0 OR LESS OR CONTAINING IRON SULFIDE SHALL BE COVERED WITH A MINIMUM DEPTH OF 12 INCHES OF SOIL HAVING A pH OF 5.0 OR MORE, IN ACCORDANCE WITH THE STANDARD FOR MANAGEMENT OF HIGH ACID PRODUCING SOIL, ("STANDARDS FOR SOIL EROSION AND SEDIMENT CONTROL IN NEW JERSEY", THE NEW JERSEY STATE SOIL CONSERVATION COMMITTEE, JULY 1999, PAGE 1-1.)

1 FRIABLE MEANS EASILY CRUMBLES IN THE FINGERS, AS DEFINED IN MOST SOILS TEXTS.
2 LOAMY MEANS TEXTURE GROUPS CONSISTING OF COARSE LOAMY SANDS, SANDY LOAM, FINE AND VERY FINE SANDY LOAM, LOAM, SILT LOAM, CLAY LOAM, SANDY CLAY LOAM AND SILTY CLAY LOAM TEXTURES AND HAVING LESS THAN 35% COARSE FRAGMENTS (PARTICLES LESS THAN 2 MILLIMETERS IN SIZE) AS DEFINED IN THE GLOSSARY OF SOIL SCIENCE TERMS, 1996, SOIL SCIENCE SOCIETY OF AMERICA.

STANDARD FOR TEMPORARY VEGETATIVE COVER FOR SOIL STABILIZATION

DEFINITION:

ESTABLISHMENT OF TEMPORARY VEGETATIVE COVER ON SOILS FOR PERIODS OF TWO TO 6 MONTHS WHICH ARE NOT BEING GRADED, NOT UNDER ACTIVE CONSTRUCTION OR NOT SCHEDULED FOR PERMANENT SEEDING WITHIN 60 DAYS.

PURPOSE:

TO TEMPORARILY STABILIZE THE SOIL AND REDUCE DAMAGE FROM WIND AND WATER EROSION UNTIL PERMANENT STABILIZATION IS ACCOMPLISHED.

WATER QUALITY ENHANCEMENT:

PROVIDES TEMPORARY PROTECTION AGAINST THE IMPACTS OF WIND AND RAIN, SLOWS THE OVER LAND MOVEMENT OF STORMWATER RUNOFF, INCREASES INFILTRATION AND RETAINS SOIL AND NUTRIENTS ON SITE, PROTECTING STREAMS OR OTHER STORMWATER CONVEYANCES.

WHERE APPLICABLE:

ON EXPOSED SOILS THAT HAVE THE POTENTIAL FOR CAUSING OFF-SITE ENVIRONMENTAL DAMAGE.

METHODS AND MATERIALS:

1. SITE PREPARATION

A. GRADE AS NEEDED AND FEASIBLE TO PERMIT THE USE OF CONVENTIONAL EQUIPMENT FOR SEEDBED PREPARATION, SEEDING, MULCH APPLICATION, AND MULCH ANCHORING. ALL GRADING SHOULD BE DONE IN ACCORDANCE WITH STANDARDS FOR LAND GRADING, 19-1.

B. INSTALL NEEDED EROSION CONTROL PRACTICES OR FACILITIES SUCH AS DIVERSIONS, GRADE STABILIZATION STRUCTURES, CHANNEL STABILIZATION MEASURES, SEDIMENT BASINS, AND WATERWAYS. SEE STANDARDS 11 THROUGH 42.

C. IMMEDIATELY PRIOR TO SEEDING, THE SURFACE SHOULD BE SCARIFIED 6" TO 12" WHERE THERE HAS BEEN SOIL COMPACTION. THIS PRACTICE IS PERMISSIBLE ONLY WHERE THERE IS NO DANGER TO UNDERGROUND UTILITIES (CABLES, IRRIGATION SYSTEMS, ETC.).

2. SEEDBED PREPARATION

A. APPLY GROUND LIMESTONE AND FERTILIZER ACCORDING TO SOIL TEST RECOMMENDATIONS SUCH AS OFFERED BY RUTGERS COOPERATIVE EXTENSION. SOIL SAMPLE MAILERS ARE AVAILABLE FROM THE LOCAL RUTGERS COOPERATIVE EXTENSION OFFICES. FERTILIZER SHALL BE APPLIED AT THE RATE OF 500 POUNDS PER ACRE OR 11 POUNDS PER 1,000 SQUARE FEET OF 10-20-10 OR EQUIVALENT WITH 50% WATER INSOLUBLE NITROGEN UNLESS A SOIL TEST INDICATES OTHERWISE. APPLY LIMESTONE AT THE RATE OF 2 TONS/ACRE UNLESS SOIL TESTING INDICATES OTHERWISE. CALCIUM CARBONATE IS THE EQUIVALENT AND STANDARD FOR MEASURING THE ABILITY OF LIMING MATERIALS TO NEUTRALIZE SOIL ACIDITY AND SUPPLY CALCIUM AND MAGNESIUM TO GRASSES AND LEGUMES. TABLE 7-1 IS A GENERAL GUIDELINE FOR LIMESTONE APPLICATION.

TABLE 7-1

LIMESTONE[1] APPLICATION RATE BY SOIL TEXTURE

SOIL TEXTURE	TONS / ACRE	LBS. / 1000 SQ. FT.
CLAY, CLAY LOAM, AND HIGH ORGANIC SOIL	3	135
SANDY LOAM, LOAM, SILT LOAM	2	90
LOAMY SAND, SAND	1	45

1 PULVERIZED DOLOMITIC LIMESTONE IS PREFERRED FOR MOST SOILS SOUTH OF THE NEW BRUNSWICK - TRENTON LINE.

B. WORK LIME AND FERTILIZER INTO THE SOIL AS NEARLY AS PRACTICAL TO A DEPTH OF 4 INCHES WITH A DISC, SPRINGTOOTH HARROW, OR OTHER SUITABLE EQUIPMENT. THE FINAL HARROWING OR DISCING OPERATION SHOULD BE ON THE GENERAL CONTOUR. CONTINUE TILLAGE UNTIL A REASONABLE UNIFORM SEEDBED IS PREPARED.

C. INSPECT SEEDBED JUST BEFORE SEEDING. IF TRAFFIC HAS LEFT THE SOIL COMPACTED, THE AREA MUST BE RETILLED IN ACCORDANCE WITH THE ABOVE.

D. SOILS IN HIGH SULFIDES OR HAVING A PH OF 4 OR LESS REFER TO STANDARD FOR MANAGEMENT OF HIGH ACID PRODUCING SOILS.

3. SEEDING

A. SELECT SEED FROM RECOMMENDATIONS IN TABLE 7-2

TABLE 7-2

TEMPORARY VEGETATIVE STABILIZATION GRASSES, SEEDING RATES, DATES AND DEPTH

SEED SELECTION	SEEDING RATE[1] (POUNDS) PER ACRE	SEEDING RATE[1] (POUNDS) PER 1000 SQ. FT.	OPTIMUM SEEDING DATE[2] BASED ON PLANT HARDINESS ZONE[3] ZONE 5b, 6a	ZONE 6b	ZONE[4] 7a,b	OPTIMUM SEEDING DEPTH[4] (INCHES)
COOL SEASON GRASSES						
1. PERENNIAL RYEGRASS	100	1.0	3/15 - 6/1 8/1 - 9/15	3/1 - 5/15 8/15 - 10/1	2/15 - 5/1 8/15 - 10/15	0.5
2. SPRING OATS	86	2.0	3/15 - 6/1 8/1 - 9/15	3/1 - 5/15 8/15 - 10/1	2/15 - 5/1 8/15 - 10/15	1.0
3. WINTER BARLEY	96	2.2	8/1 - 10/1	8/15 - 10/1	8/15 - 10/15	1.0
4. WINTER CEREAL RYE	112	2.8	8/1 - 11/1	8/1 - 11/15	8/1 - 12/15	1.0
WARM SEASON GRASSES						
1. PEARL MILLET	20	0.5	6/1 - 8/1	5/15 - 8/15	5/1 - 9/1	1.0
2. MILLET (GERMAN OR HUNGARIAN)	30	0.7	6/1 - 8/1	5/15 - 8/15	5/1 - 9/1	1.0
3. WEEPING LOVEGRASS	5	0.2	6/1 - 8/1	5/15 - 8/15	5/1 - 9/1	0.25

1 SEEDING RATE FOR WARM SEASON GRASS, SELECTIONS 5-7 SHALL BE ADJUSTED TO REFLECT THE AMOUNT OF PURE LIVE SEED (PLS) AS DETERMINED BY A GERMINATION TEST RESULT. NO ADJUSTMENT IS REQUIRED FOR COOL SEASON GRASSES.
2 MAY BE PLANTED THROUGHOUT SUMMER IF SOIL MOISTURE IS ADEQUATE OR SEEDED AREA CAN BE IRRIGATED.
3 TWICE THE DEPTH FOR SANDY SOILS.
4 THIS PROJECT IS LOCATED IN ZONE 6a, AS INDICATED IN FIGURE 4-1, "PLANT HARDINESS ZONES", "STANDARDS FOR SOIL EROSION AND SEDIMENT CONTROL IN NEW JERSEY", THE NEW JERSEY STATE SOIL CONSERVATION COMMITTEE, JULY 1999, PAGE 4-15.

FREEHOLD SOIL EROSION AND SEDIMENT CONTROL NOTES

1. THE FREEHOLD SOIL CONSERVATION DISTRICT SHALL BE NOTIFIED SEVENTY-TWO (72) HOURS IN ADVANCE OF ANY LAND DISTURBING ACTIVITY.

2. ALL WORK IS TO BE DONE IN ACCORDANCE WITH THE STATE STANDARDS FOR SOIL EROSION AND SEDIMENT CONTROL OF NEW JERSEY.

3. ALL SOIL EROSION AND SEDIMENT CONTROL PRACTICES ARE TO BE INSTALLED PRIOR TO ANY MAJOR SOIL DISTURBANCE, OR IN THEIR PROPER SEQUENCE, AND MAINTAINED UNTIL PERMANENT PROTECTION IS ESTABLISHED.

4. ANY CHANGES TO THE CERTIFIED SOIL EROSION AND SEDIMENT CONTROL PLANS WILL REQUIRE THE SUBMISSION OF REVISED SOIL EROSION AND SEDIMENT CONTROL PLANS TO THE DISTRICT FOR RE-CERTIFICATION. THE REVISED PLANS MUST MEET ALL CURRENT STATE SOIL EROSION AND SEDIMENT CONTROL STANDARDS.

5. IN THAT NJSA 4:24-39 ET. SEQ. REQUIRES THAT NO CERTIFICATES OF OCCUPANCY BE ISSUED BEFORE THE PROVISIONS OF THE CERTIFIED PLAN FOR EROSION CONTROL HAVE BEEN COMPLIED WITH FOR PERMANENT MEASURES. ALL SITE WORK AND ALL WORK AROUND INDIVIDUAL LOTS IN SUBDIVISIONS, WILL HAVE TO BE COMPLETED PRIOR TO THE DISTRICT ISSUING A REPORT OF COMPLIANCE FOR THE ISSUANCE OF A CERTIFICATE OF OCCUPANCY BY THE MUNICIPALITY.

6. ANY DISTURBED AREAS THAT WILL BE LEFT EXPOSED MORE THAN THIRTY (30) DAYS, AND NOT SUBJECT TO CONSTRUCTION TRAFFIC, WILL IMMEDIATELY RECEIVE A TEMPORARY SEEDING. IF THE SEASON PREVENTS THE ESTABLISHMENT OF TEMPORARY COVER, THE DISTURBED AREAS WILL BE MULCHED WITH STRAW, OR EQUIVALENT MATERIAL, AT A RATE OF 2 TO 2 1/2 TONS PER ACRE, ACCORDING TO STATE STANDARD FOR STABILIZATION WITH MULCH ONLY.

7. IMMEDIATELY FOLLOWING INITIAL DISTURBANCE OR ROUGH GRADING, ALL CRITICAL AREAS SUBJECT TO EROSION (I.E. STEEP SLOPES AND ROADWAY EMBANKMENTS) WILL RECEIVE TEMPORARY SEEDING IN COMBINATION WITH STRAW MULCH OR A SUITABLE EQUIVALENT, AT A RATE OF 1 1/2 TO 2 TONS PER ACRE, ACCORDING TO STATE STANDARDS.

8. A SUB-BASE COURSE WILL BE APPLIED IMMEDIATELY FOLLOWING ROUGH GRADING AND INSTALLATION OF IMPROVEMENTS TO STABILIZE STREETS, ROADS, DRIVEWAYS, AND PARKING AREAS. IN AREAS WHERE NO UTILITIES ARE PRESENT, THE SUB-BASE SHALL BE INSTALLED WITHIN FIFTEEN (15) DAYS OF THE PRELIMINARY GRADING.

9. ANY STEEP SLOPES RECEIVING PIPELINE INSTALLATION WILL BE BACKFILLED AND STABILIZED DAILY, AS THE INSTALLATION CONTINUES (I.E. SLOPES GREATER THAN 3:1).

10. THE STANDARD FOR STABILIZED CONSTRUCTION ACCESS REQUIRES THE INSTALLATION OF A PAD OF CLEAN CRUSHED STONE AT POINTS WHERE TRAFFIC WILL BE ACCESSING THE CONSTRUCTION SITE. AFTER INTERIOR ROADWAYS ARE PAVED, INDIVIDUAL LOTS REQUIRE A STABILIZED CONSTRUCTION ENTRANCE CONSISTING OF ONE INCH TO TWO INCH (1"-2") STONE FOR A MINIMUM LENGTH OF TEN FEET (10') EQUAL TO THE LOT ENTRANCE WIDTH. ALL OTHER ACCESS POINTS SHALL BE BLOCKED OFF.

11. ALL SOIL WASHED, DROPPED, SPILLED, OR TRACKED OUTSIDE THE LIMIT OF DISTURBANCE OR ONTO PUBLIC RIGHT-OF-WAYS WILL BE REMOVED IMMEDIATELY.

12. PERMANENT VEGETATION IS TO BE SEEDED OR SODDED ON ALL EXPOSED AREAS WITHIN TEN (10) DAYS AFTER FINAL GRADING.

13. AT THE TIME THAT SITE PREPARATION FOR PERMANENT VEGETATIVE STABILIZATION IS GOING TO BE ACCOMPLISHED, ANY SOIL THAT WILL NOT PROVIDE A SUITABLE ENVIRONMENT TO SUPPORT ADEQUATE VEGETATIVE GROUND COVER SHALL BE REMOVED OR TREATED IN SUCH A WAY THAT IT WILL PERMANENTLY ADJUST THE SOIL CONDITIONS AND RENDER IT SUITABLE FOR VEGETATIVE GROUND COVER. IF THE REMOVAL OR TREATMENT OF THE SOIL WILL NOT PROVIDE SUITABLE CONDITIONS, NON-VEGETATIVE MEANS OF PERMANENT GROUND STABILIZATION WILL HAVE TO BE EMPLOYED.

14. IN ACCORDANCE WITH THE STANDARD FOR MANAGEMENT OF HIGH ACID PRODUCING SOILS, ANY SOIL HAVING A PH OF 4 OR LESS OR CONTAINING IRON SULFIDES SHALL BE COVERED WITH A MINIMUM OF TWELVE (12) INCHES OF SOIL HAVING A PH OF 5 OR MORE PRIOR TO SEEDBED PREPARATION. AREAS WHERE TREES OR SHRUBS ARE TO BE PLANTED SHALL BE COVERED WITH A MINIMUM OF TWENTY- FOUR (24) INCHES OF SOIL HAVING A PH OF 5 OR MORE.

15. CONDUIT OUTLET PROTECTION MUST BE INSTALLED AT ALL REQUIRED OUTFALLS PRIOR TO THE DRAINAGE SYSTEM BECOMING OPERATIONAL.

16. UNFILTERED DEWATERING IS NOT PERMITTED. NECESSARY PRECAUTIONS MUST BE TAKEN DURING ALL DEWATERING OPERATIONS TO MINIMIZE SEDIMENT TRANSFER. ANY DEWATERING METHODS USED MUST BE IN ACCORDANCE WITH THE STANDARD FOR DEWATERING.

17. SHOULD THE CONTROL OF DUST AT THE SITE BE NECESSARY, THE SITE WILL BE SPRINKLED UNTIL THE SURFACE IS WET, TEMPORARY VEGETATIVE COVER SHALL BE ESTABLISHED OR MULCH SHALL BE APPLIED AS REQUIRED BY THE STANDARD FOR DUST CONTROL.

18. STOCKPILE AND STAGING LOCATIONS ESTABLISHED IN THE FIELD SHALL BE PLACED WITHIN THE LIMIT OF DISTURBANCE ACCORDING TO THE CERTIFIED PLAN. STAGING AND STOCKPILES NOT LOCATED WITHIN THE LIMIT OF DISTURBANCE WILL REQUIRE CERTIFICATION OF A REVISED SOIL EROSION AND SEDIMENT CONTROL PLAN. CERTIFICATION OF A NEW SOIL EROSION AND SEDIMENT CONTROL PLAN MAY BE REQUIRED FOR THESE ACTIVITIES IF AN AREA GREATER THAN 5,000 SQUARE FEET IS DISTURBED.

19. ALL SOIL STOCKPILES ARE TO BE TEMPORARILY STABILIZED IN ACCORDANCE WITH SOIL EROSION AND SEDIMENT CONTROL NOTE #6.

20. THE PROPERTY OWNER SHALL BE RESPONSIBLE FOR ANY EROSION OR SEDIMENTATION THAT MAY OCCUR BELOW STORMWATER OUTFALLS OR OFFSITE AS A RESULT OF CONSTRUCTION OF THE PROJECT.

21. PERMANENT STABILIZATION SPECIFICATIONS
A) APPLY TOPSOIL TO A DEPTH OF 5 INCHES (UNSETTLED)
B) APPLY GROUND LIMESTONE AT A RATE OF 90 LBS. PER 1000 SQ. FT. AND WORK FOUR INCHES INTO SOIL
C) APPLY FERTILIZER (10-20-10) AT A RATE 11 LBS. PER 1000 SQ. FT.
D) APPLY HARD FESCUE SEED AT 2.7 LBS. PER 1000 SQ. FT. AND CREEPING RED FESCUE SEED AT 0.7 LBS. PER 1000 SQ. FT. AND PERENNIAL RYEGRASS SEED AT 0.25 LBS. PER 1000 SQ. FT.
E) MULCH STOCKPILE WITH STRAW OR HAY AT A RATE OF 90 LBS. PER 1000 SQ. FT.
F) APPLY A LIQUID MULCH BINDER OR TACT TO STRAW OR HAY MULCH.

*NOTE: 72 HOURS PRIOR TO ANY SOIL DISTURBANCE, NOTICE IN WRITING, SHALL BE GIVEN TO THE FREEHOLD SOIL CONSERVATION DISTRICT AND A PRE-CONSTRUCTION MEETING HELD.

STANDARD FOR PERMANENT VEGETATIVE COVER FOR SOIL STABILIZATION

(REFER TO SHEET 4 OF 6 FOR SEED MIX FOR STABILIZATION)

DEFINITION:

ESTABLISHMENT OF PERMANENT VEGETATIVE COVER ON EXPOSED SOILS WHERE PERENNIAL VEGETATION IS NEEDED FOR LONG TERM PROTECTION.

PURPOSE:

TO PERMANENTLY STABILIZE THE SOIL, ASSURING CONSERVATION OF SOIL AND WATER, AND TO ENHANCE THE ENVIRONMENT.

WATER QUALITY ENHANCEMENT:

SLOWS THE OVERLAND MOVEMENT OF STORMWATER RUNOFF, INCREASES INFILTRATION AND RETAINS SOIL AND NUTRIENTS ON SITE, PROTECTING STREAMS OR OTHER STORMWATER CONVEYANCES.

WHERE APPLICABLE:

ON EXPOSED SOILS THAT HAVE A POTENTIAL FOR CAUSING OFF-SITE ENVIRONMENTAL DAMAGE.

METHODS AND MATERIALS:

1. SITE PREPARATION

A. GRADE AS NEEDED AND FEASIBLE TO PERMIT THE USE OF CONVENTIONAL EQUIPMENT FOR SEEDBED PREPARATION, SEEDING, MULCH APPLICATION, AND MULCH ANCHORING. ALL GRADING SHOULD BE DONE IN ACCORDANCE WITH STANDARD FOR LAND GRADING ("STANDARDS FOR SOIL EROSION AND SEDIMENT CONTROL IN NEW JERSEY", THE NEW JERSEY STATE SOIL CONSERVATION COMMITTEE, JULY, 1999, PAGE 19-1.)

B. IMMEDIATELY PRIOR TO TOPSOILING, THE SURFACE SHOULD BE SCARIFIED 6 TO 12 INCHES WHERE THERE HAS BEEN SOIL COMPACTION. THIS WILL HELP INSURE A GOOD BOND BETWEEN THE TOPSOIL AND SUBSOIL. ***THIS PRACTICE IS PERMISSIBLE ONLY WHERE THERE IS NO DANGER TO UNDERGROUND UTILITIES (CABLES, IRRIGATION SYSTEMS, ETC.)***

C. EMPLOY NEEDED EROSION CONTROL PRACTICES SUCH AS DIVERSIONS, GRADE STABILIZATION STRUCTURES, CHANNEL STABILIZATION MEASURES, SEDIMENTATION BASINS, AND WATERWAYS. SEE STANDARDS 11 THROUGH 42, "STANDARDS FOR SOIL EROSION AND SEDIMENT CONTROL IN NEW JERSEY", THE NEW JERSEY STATE SOIL CONSERVATION COMMITTEE, JULY 1999.

2. SEEDBED PREPARATION

A. APPLY GROUND LIMESTONE AND FERTILIZER ACCORDING TO SOIL TEST RECOMMENDATIONS SUCH AS OFFERED BY RUTGERS CO-OPERATIVE EXTENSION. SOIL SAMPLE MAILERS ARE AVAILABLE FROM THE LOCAL RUTGERS COOPERATIVE EXTENSION OFFICES. FERTILIZER SHALL BE APPLIED AT THE RATE OF 500 POUNDS PER ACRE OR 11 POUNDS PER 1,000 SQUARE FEET OF 10-20-10 OR EQUIVALENT WITH 50% WATER INSOLUBLE NITROGEN UNLESS A SOIL TEST INDICATES OTHERWISE. APPLY LIMESTONE IN ACCORDANCE WITH TABLE 4-1 AND THE RESULTS OF SOIL TESTING. CALCIUM CARBONATE IS THE EQUIVALENT AND STANDARD FOR MEASURING THE ABILITY OF LIMING MATERIALS TO NEUTRALIZE SOIL ACIDITY AND SUPPLY CALCIUM AND MAGNESIUM TO GRASSES AND LEGUMES. TABLE 4-1 IS A GENERAL GUIDELINE FOR LIMESTONE APPLICATION RATES.

B. WORK LIME AND FERTILIZER INTO THE SOIL AS NEARLY AS PRACTICAL TO A DEPTH OF 4 INCHES WITH A DISC, SPRINGTOOTH HARROW, OR OTHER SUITABLE EQUIPMENT. THE FINAL HARROWING OR DISCING OPERATION SHOULD BE ON THE GENERAL CONTOUR. CONTINUE TILLAGE UNTIL A REASONABLE UNIFORM SEEDBED IS PREPARED.

C. IMMEDIATELY PRIOR TO TOPSOILING, THE SURFACE SHOULD BE SCARIFIED 6 TO 12 INCHES WHERE THERE HAS BEEN SOIL COMPACTION. THIS WILL HELP INSURE A GOOD BOND BETWEEN THE TOPSOIL AND SUBSOIL. ***THIS PRACTICE IS PERMISSIBLE ONLY WHERE THERE IS NO DANGER TO UNDERGROUND UTILITIES (CABLES, IRRIGATION SYSTEMS, ETC.)***

D. A UNIFORM APPLICATION TO A DEPTH OF 5 INCHES (UNSETTLED) IS RECOMMENDED. SOILS WITH A Ph OF 4.0 OR LESS OR CONTAINING IRON SULFIDE SHALL BE COVERED WITH A MINIMUM DEPTH OF 12 INCHES OF SOIL HAVING A pH OF 5.0 OR MORE, IN ACCORDANCE WITH THE STANDARD FOR MANAGEMENT OF HIGH ACID PRODUCING SOIL, ("STANDARDS FOR SOIL EROSION AND SEDIMENT CONTROL IN NEW JERSEY", THE NEW JERSEY STATE SOIL CONSERVATION COMMITTEE, JULY 1999, PAGE 1-1.)

3. SEEDING

A. USE THE PROPER MIXTURE AS INDICATED IN TABLE 4-3 OR USE A MIXTURE RECOMMENDED BY RUTGERS COOPERATIVE EXTENSION OR NATURAL RESOURCES CONSERVATION SERVICE WHICH IS APPROVED BY THE SOIL CONSERVATION DISTRICT. SEED GERMINATION SHALL HAVE BEEN TESTED WITHIN 12 MONTHS OF THE PLANTING DATE. NO SEED SHALL BE ACCEPTED WITH A GERMINATION TEST DATE MORE THAN 12 MONTHS OLD UNLESS RETESTED.

1. SEEDING RATES SPECIFIED ARE REQUIRED WHEN A REPORT OF COMPLIANCE IS REQUESTED PRIOR TO ACTUAL ESTABLISHMENT OF PERMANENT VEGETATION. UP TO 50% REDUCTION IN RATES MAY BE USED WHEN PERMANENT VEGETATION IS ESTABLISHED PRIOR TO A REPORT OF COMPLIANCE INSPECTION. THESE RATES APPLY TO ALL METHODS OF SEEDING. ESTABLISHING PERMANENT VEGETATION MEANS 80% VEGETATIVE COVERAGE WITH THE SPECIFIED SEED MIXTURE FOR THE SEEDBED AREA AND MOWED ONCE.

2. WARM SEASON MIXTURES ARE GRASSES AND LEGUMES WHICH MAXIMIZE GROWTH AT HIGH TEMPERATURES, GENERALLY 85°F AND ABOVE. SEE TABLE 4-3, MIXTURES 1 TO 7. PLANTING RATES FOR WARM SEASON GRASSES SHALL BE THE AMOUNT OF PURE LIVE SEED (PLS) AS DETERMINED BY GERMINATION TESTING RESULTS.

3. COOL SEASON MIXTURES ARE GRASSES AND LEGUMES WHICH MAXIMIZE GROWTH AT LOW TEMPERATURES, GENERALLY BELOW 85°F. SEE TABLE 4-3, MIXTURES 8 TO 20. ADJUSTMENT OF PLANTING RATES FOR COOL SEASON GRASSES FOR THE AMOUNT OF PURE LIVE SEED (PLS) IS NOT REQUIRED.

B. **CONVENTIONAL SEEDING** IS PERFORMED BY APPLYING SEED UNIFORMLY BY HAND, CYCLONE (CENTRIFUGAL) SEEDER, DROP SEEDER, DRILL OR CULTIPACKER. EXCEPT FOR DRILLED, HYDROSEEDED OR CULTIPACKED SEEDINGS, SEED SHALL BE INCORPORATED INTO THE SOIL WITHIN 24 HOURS OF SEEDBED PREPARATION TO A DEPTH OF 1/4 TO 1/2 INCH, BY RAKING OR DRAGGING. DEPTH OF SEED PLACEMENT MAY BE 1/4 INCH DEEPER ON COARSE TEXTURED SOIL.

C. **HYDROSEEDING** IS A BROADCAST SEEDING METHOD USUALLY INVOLVING A TRUCK OR TRAILER MOUNTED TANK, WITH AN AGITATION SYSTEM AND HYDRAULIC PUMP FOR MIXING SEED, WATER AND FERTILIZER AND SPRAYING THE MIX ONTO THE PREPARED SEEDBED. MULCH **SHALL NOT** BE INCLUDED IN THE TANK WITH SEED. SHORT FIBERED MULCH MAY BE APPLIED WITH A HYDROSEEDER FOLLOWING SEEDING. (ALSO SEE SECTION IV MULCHING BELOW) HYDROSEEDING IS **NOT PREFERRED SEEDING METHOD** BECAUSE SEED AND FERTILIZER ARE APPLIED TO THE SURFACE AND INCORPORATED INTO THE SOIL. POOR SEED TO SOIL CONTACT OCCURS REDUCING SEED GERMINATION AND GROWTH. HYDROSEEDING MAY BE USED FOR AREAS TO STEEP FOR CONVENTIONAL EQUIPMENT TO TRAVERSE OR TOO OBSTRUCTED WITH ROCKS, STUMPS, ETC.

D. AFTER SEEDING, FIRMING THE SOIL WITH A CORRUGATED ROLLER WILL ASSURE GOOD SEED TO SOIL CONTACT, RESTORE CAPILLARITY, AND IMPROVE SEEDLING EMERGENCE. **THIS IS THE PREFERRED METHOD**. WHEN PERFORMED ON THE CONTOUR, SHEET EROSION WILL BE MINIMIZED AND WATER CONSERVATION ON SITE WILL BE MAXIMIZED.

4. MULCHING

MULCHING IS REQUIRED ON ALL SEEDING. MULCH WILL INSURE AGAINST EROSION BEFORE GRASS IS ESTABLISHED AND WILL PROMOTE FASTER AND EARLIER ESTABLISHMENT. THE EXISTENCE OF VEGETATION SUFFICIENT TO CONTROL SOIL EROSION SHALL BE DEEMED IN COMPLIANCE WITH THIS MULCHING REQUIREMENT.

A. **STRAW OR HAY.** UNROTTED SMALL GRAIN STRAW, HAY FREE OF SEEDS, OR SALT HAY TO BE APPLIED AT THE RATE OF 1-1/2 TO 2 TONS PER ACRE (70 TO 90 POUNDS PER 1,000 SQUARE FEET), EXCEPT THAT WHERE A CRIMER IS USED INSTEAD OF LIQUID MULCH-BINDER (TACKIFYING OR ADHESIVE AGENT), THE RATE OF APPLICATION IS 3 TONS PER ACRE. MULCH CHOPPER-BLOWERS **MUST NOT** GRIND THE MULCH. HAY MULCH IS NOT RECOMMENDED FOR ESTABLISHING FINE TURF OR LAWNS DUE TO THE PRESENCE OF WEED SEED.

APPLICATION. SPREAD MULCH UNIFORMLY BY HAND OR MECHANICALLY SO THAT APPROXIMATELY 85% OF THE SOIL SURFACE WILL BE COVERED. FOR UNIFORM DISTRIBUTION OF HAND-SPREAD MULCH, DIVIDE AREA INTO APPROXIMATELY 1,000 SQUARE FEET SECTIONS AND DISTRIBUTE 70 TO 90 POUNDS WITHIN EACH SECTION.

ANCHORING. ANCHORING SHALL BE ACCOMPLISHED IMMEDIATELY AFTER PLACEMENT TO MINIMIZE LOSS BY WIND AND WATER. THIS MAY BE DONE BY ONE OF THE FOLLOWING METHODS, DEPENDING UPON THE SIZE OF THE AREA, STEEPNESS OF SLOPES, AND COSTS.

1. PEG AND TWINE. DRIVE 8 TO 10 INCH WOODEN PEGS TO WITHIN 2 TO 3 INCHES OF THE SOIL SURFACE EVERY 4 FEET IN ALL DIRECTIONS. STAKES MAY BE DRIVEN BEFORE OR AFTER APPLYING MULCH. SECURE MULCH TO SOIL SURFACE BY STRETCHING TWINE BETWEEN PEGS IN A CRISS-CROSS AND SQUARE PATTERN. SECURE TWINE AROUND EACH PEG WITH TWO OR MORE TURNS.
2. MULCH NETTINGS. STAPLE PAPER, JUTE, COTTON, OR PLASTIC NETTINGS TO THE SOIL SURFACE. USE A DEGRADABLE NETTING IN AREAS TO BE MOVED.
3. CRIMPER (MULCH ANCHORING COULTER TOOL). A TRACTOR-DRAWN IMPLEMENT, SOMEWHAT LIKE A DISC HARROW, ESPECIALLY DESIGNED TO PUSH OR CUT SOME OF THE BROADCAST LON FIBER MULCH 3 TO 4 INCHES INTO THE SOIL SO AS TO ANCHOR IT AND LEAVE PART STANDING UPRIGHT. THIS TECHNIQUE IS LIMITED TO AREAS TRAVERSABLE BY A TRACTOR, WHICH MUST OPERATE ON THE CONTOUR OF SLOPES. STRAW MULCH RATE MUST BE 3 TONS PER ACRE. NO ADHESIVE AGENT IS REQUIRED.
4. LIQUID MULCH BINDERS. MAY BE USED TO ANCHOR SALT HAY, HAY AND STRAW MULCH.
   a. APPLICATIONS SHOULD BE HEAVIER AT EDGES WHERE WIND MAY CATCH THE MULCH, IN VALLEYS, AND AT CRESTS OF BANKS. THE REMAINDER OF THE AREA SHOULD BE UNIFORM IN APPEARANCE.
   b. USE ONE OF THE FOLLOWING:
      (1) EMULSIFIED ASPHALT (SS-1, CSS-1, CMS-2, MS-2, RS-1, RS-2, CRS-1, AND CRS-2). APPLY 0.04 GALLONS PER SQUARE YARD OR 194 GALLONS PER ACRE ON FLAT AREAS AND ON SLOPES LESS THAN 8 FEET OF MORE HIGH, USE 0.075 GALLONS PER SQUARE YARD OR 363 GALLONS PER ACRE. THESE MATERIALS MAY BE DIFFICULT TO APPLY UNIFORMLY AND WILL DISCOLOR SURFACES.
      (2) ORGANIC AND VEGETABLE BASED BINDERS. NATURALLY OCCURRING, POWDER BASED, HYDROPHILIC MATERIALS WHEN MIXED WITH WATER FORMULATES A GEL AND WHEN APPLIED TO MULCH UNDER SATISFACTORY CURING CONDITIONS WILL FORM MEMBRANED NETWORKS OF INSOLUBLE POLYMERS. THE VEGETABLE GEL SHALL BE PHYSIOLOGICALLY HARMLESS AND NOT RESULT IN A PHYTOTOXIC EFFECT OR IMPEDE GROWTH OF TURFGRASS. USE AT A RATE AND WEATHER CONDITIONS AS RECOMMENDED BY THE MANUFACTURER TO ANCHOR MULCH MATERIALS. **MANY NEW PRODUCTS AREA AVAILABLE, SOME OF WHICH MAY NEED FURTHER EVALUATION FOR USE IN THIS STATE.**
      (3) SYNTHETIC BINDERS. HIGH POLYMER SYNTHETIC EMULSION, MISCIBLE WITH WATER WHEN DILUTED AND FOLLOWING APPLICATION TO MULCH, DRYING AND CURING SHALL NO LONGER BE SOLUBLE OR DISPERSIBLE IN WATER. IT SHALL BE APPLIED AT RATES RECOMMENDED BY THE MANUFACTURER AND REMAIN TACKY UNTIL GERMINATION OF GRASS.

      NOTE: NAMES GIVEN ABOVE ARE REGISTERED TRADE NAMES. THIS DOES NOT CONSTITUTE A RECOMMENDATION OF THESE PRODUCTS TO THE EXCLUSION OF OTHER PRODUCTS.

B. **WOOD FIBER OR PAPER FIBER MULCH.** SHALL BE MADE FROM WOOD, PLANT FIBERS OR PAPER CONTAINING NO GROWTH OR GERMINATION INHIBITING MATERIALS, USED AT THE RATE OF 1,500 POUNDS PER ACRE (OR AS RECOMMENDED BY THE PRODUCT MANUFACTURER) AND MAY BE APPLIED BY A HYDROSEEDER. THIS MULCH SHALL NOT BE MIXED IN THE TANK WITH SEED. USE IS **LIMITED** TO FLATTER SLOPES AND DURING OPTIMUM SEEDING PERIODS IN SPRING AND FALL.

C. **PELLETIZED MULCH.** COMPRESSED AND EXTRUDED PAPER AND/OR WOOD FIBER PRODUCT, WHICH MAY CONTAIN CO-POLYMERS, TACKIFIERS, FERTILIZERS AND COLORING AGENTS. THE DRY PELLETS, WHEN APPLIED TO A SEEDED AREA AND WATERED, FORM A MULCH MAT. PELLETIZED MULCH SHALL BE APPLIED IN ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATIONS. MULCH MAY BE APPLIED BY HAND OR MECHANICAL SPREADER AT THE RATE OF 60-75 POUNDS PER 1,000 SQUARE FEET AND ACTIVATED WITH 0.2 TO 0.4 INCHES OF WATER. THIS MATERIAL HAS BEEN FOUND TO BE BENEFICIAL FOR USE ON SMALL LAWN OR RENOVATION AREAS, SEEDED AREAS WHERE WEED-SEED FREE MULCH IS DESIRED OR ON SITES WHERE STRAW MULCH AND TACKIFIER AGENT ARE NOT PRACTICAL OR DESIRABLE. APPLYING THE FULL 0.2 TO 0.4 INCHES OF WATER AFTER SPREADING PELLETIZED MULCH ON THE SEED BED IS EXTREMELY IMPORTANT FOR SUFFICIENT AND EXPANSION OF THE MULCH TO PROVIDE SOIL COVERAGE.

STANDARD FOR PERMANENT VEGETATIVE COVER FOR SOIL STABILIZATION (CONT.)

5. IRRIGATION (WHERE FEASIBLE)

IF SOIL IS DEFICIENT, AND MULCH IS NOT USED, SUPPLY NEW SEEDINGS WITH ADEQUATE WATER (A MINIMUM OF 1/4 INCH TWICE A DAY UNTIL VEGETATION IS WELL ESTABLISHED). THIS IS ESPECIALLY TRUE WHEN SEEDINGS ARE MADE IN ABNORMALLY DRY OR HOT WEATHER OR ON DROUGHTY SITES.

6. TOPDRESSING

SINCE LOW RELEASE NITROGEN FERTILIZER (WATER SOLUBLE) IS PRESCRIBED IN SECTION II.A. SEEDBED PREPARATION IN THIS STANDARD, NO FOLLOW-UP OF TOPDRESSING IS MANDATORY. AN EXCEPTION MAY BE WHERE GROSS NITROGEN DEFICIENCY EXISTS TO THE EXTENT THAT TURF FAILURE MAY DEVELOP. IN THAT INSTANCE, TOPDRESS WITH 10-10-10 OR EQUIVALENT AT 400 POUNDS PER 1,000 SQUARE FEET.

7. ESTABLISHING PERMANENT VEGETATIVE STABILIZATION

THE QUALITY OF PERMANENT VEGETATION RESTS WITH THE CONTRACTOR. THE TIMING OF SEEDING, PREPARATION THE SEEDBED, APPLYING NUTRIENTS, MULCH AND OTHER MANAGEMENT ARE ESSENTIAL. THE SEED APPLICATION RATES IN TABLE 4-3 ARE REQUIRED WHEN A **REPORT OF COMPLIANCE** IS REQUESTED PRIOR TO ACTUAL ESTABLISHMENT OF PERMANENT VEGETATION. UP TO 50% REDUCTION IN APPLICATION RATES MAY BE USED WHEN PERMANENT VEGETATION IS ESTABLISHED PRIOR TO REQUESTING A **REPORT OF COMPLIANCE** FROM THE DISTRICT. THESE RATES APPLY TO ALL METHODS OF SEEDING. **ESTABLISHING PERMANENT VEGETATION MEANS 80% VEGETATIVE COVER (OF THE SEEDED SPECIES) AND MOWED ONCE.**

STANDARD FOR LAND GRADING

DEFINITION:

RESHAPING THE GROUND SURFACE BY GRADING TO PLANNED ELEVATIONS WHICH ARE DETERMINED BY TOPOGRAPHIC SURVEY AND LAYOUT.

PURPOSE:

THE PRACTICE IS FOR ONE OR MORE OF THE FOLLOWING: PROVIDE MORE SUITABLE SITES FOR LAND DEVELOPMENT; IMPROVE SURFACE DRAINAGE AND CONTROL EROSION.

CONDITIONS WHERE PRACTICES APPLIES:

THIS PRACTICE IS APPLICABLE WHERE GRADING TO PLANNED ELEVATIONS IS PRACTICAL AND IT IS DETERMINED THAT GRADING IS NEEDED. GRADING THAT INVOLVES THE DISTURBANCE OF VEGETATION OVER LARGE AREAS SHALL BE AVOIDED. IT MAY BE NECESSARY TO PROVIDE TEMPORARY STABILIZATION OVER LARGE AREAS.

WATER QUALITY ENHANCEMENT:

PROPER GRADING OF DISTURBED SITES WILL PROTECT AGAINST SOIL LOSS FROM EROSION, ENHANCE ESTABLISHMENT OF PERMANENT VEGETATIVE COVER AND HELP TO PROPERLY MANAGE STORMWATER RUNOFF ALL OF WHICH WILL REDUCE OFFSITE DISCHARGE OF POLLUTANTS.

PLANNING CRITERIA:

EROSION CONTROL MEASURES SHALL BE INSTALLED IN ACCORDANCE WITH THE APPLICABLE STANDARD CONTAINED HEREIN. THE CUT FACE OF EARTH EXCAVATIONS AND FILLS SHALL BE NO STEEPER THAN THE SAFE ANGLE OF REPOSE FOR THE MATERIALS ENCOUNTERED AND FLAT ENOUGH FOR MAINTENANCE AND WILL BE NO GREATER THAN TWO (2) HORIZONTAL TO ONE (1) VERTICAL IN ANY SITUATION. PERMANENTLY EXPOSED FACES OF EARTH CUTS AND FILLS SHALL BE VEGETATED OR OTHERWISE PROTECTED EROSION. PROVISIONS SHALL BE MADE TO SAFELY CONDUCT SURFACE WATER TO STORM DRAINS OR SUITABLE WATER COURSES AND PREVENT SURFACE RUNOFF FROM DAMAGING CUT FACES AND FILL SLOPES. ADJACENT PROPERTIES SHALL BE PROTECTED FROM EXCAVATION AND FILLING OPERATIONS.

STANDARD FOR MANAGEMENT OF HIGH ACID PRODUCING SOILS

DEFINITION:

IDENTIFYING HIGH ACID PRODUCING SOIL WHICH MAY BE EXPOSED DURING EXCAVATION AN LAND GRADING ACTIVITIES AND PRACTICES FOR ITS BURIAL. HIGH ACID PRODUCING SOILS WITH A pH OF 4 OR LESS OR CONTAIN IRON SULFIDE.

PURPOSE:

TO PREVENT OR LIMIT EXPOSURE, EXPOSURE TIME AND SPREADING BY EQUIPMENT OR RAINFALL ON AND OFF SITE AND MINIMIZE EROSION, SEDIMENTATION AND ACID LEACHATE RELATED DAMAGES.

WATER QUALITY ENHANCEMENT:

PROTECTS ON SITE SOILS AND OFFSITE STREAMS AND LAKES FROM SULFURIC ACID LEACHATE WHICH CREATES SOIL pH CONDITIONS UNSUITABLE FOR GROWTH OF VEGETATION.

CONDITIONS WHERE PRACTICES APPLIES:

THIS PRACTICE IS APPLICABLE TO ANY HIGH ACID PRODUCING SOIL MATERIALS. SUCH MATERIALS HAVE BEEN FOUND IN THE COASTAL PLAIN AREAS OF BURLINGTON, CAMDEN, GLOUCESTER, MERCER, MIDDLESEX, MONMOUTH, OCEAN AND SALEM COUNTIES.

PLANNING CRITERIA:

EARLY RECOGNITION AND BURIAL, REMOVAL, OR DISPOSAL OF HIGH ACID PRODUCING SOILS IS ESSENTIAL FOR LIMITING THE AMOUNT OF ACIDIC MATERIAL PRODUCED.

REVIEW A SURFACE GEOLOGY MAP FOR THE PROPOSED SITE TO INVESTIGATE THE PRESENCE OF GEOLOGIC FORMATIONS WHICH COMMONLY CONTAIN HIGH ACID PRODUCING DEPOSITS. THE GEOLOGIC FORMATIONS ARE AS FOLLOWS:

ENGLISHTOWN SAND	NAVESINK FORMATION
KIRKWOOD FORMATION	RARITAN FORMATION
MAGOTHY FORMATION	RED BANK SAND
MARSHALLTOWN FORMATION	WOODBURY CLAY
MERCHANTVILLE FORMATION	

METHODS AND MATERIALS:

1. LIMIT THE EXCAVATION AREA AND EXPOSURE TIME WHEN HIGH ACID PRODUCING SOILS ARE ENCOUNTERED.

2. TOPSOIL STRIPPED FROM THE SITE SHALL BE STORED SEPARATELY FROM TEMPORARILY STOCKPILED HIGH ACID PRODUCING SOILS.

3. STOCKPILES OF HIGH ACID PRODUCING SOIL SHOULD BE LOCATED ON LEVEL LAND TO MINIMIZE ITS MOVEMENT, ESPECIALLY WHEN THE MATERIAL HAS A HIGH CLAY CONTENT.

4. TEMPORARILY STOCKPILED HIGH ACID PRODUCING SOIL MATERIAL TO BE EXPOSED MORE THAN 30 DAYS SHOULD BE COVERED WITH PROPERLY ANCHORED , HEAVY GRADE SHEETS OF POLYETHYLENE WHERE POSSIBLE. IF NOT POSSIBLE, STOCKPILES SHALL BE COVERED WITH A MINIMUM OF 3 TO 6 INCHES OF WOOD CHIPS TO MINIMIZE EROSION OF THE STOCKPILE. SILT FENCE TO BE INSTALLED AT THE TOE OF SLOPE TO CONTAIN MOVEMENT OF THE STOCKPILED MATERIAL. TOPSOIL SHALL NOT BE APPLIED TO THE STOCKPILES TO PREVENT TOPSOIL CONTAMINATION WITH HIGH ACID PRODUCING SOIL.

5. HIGH ACID PRODUCING SOILS WITH A pH OF 4 OR LESS, OR CONTAINING IRON SULFIDE, (INCLUDING BORROW FROM CUTS) SHALL BE ULTIMATELY PLACED OR BURIED WITH LIMESTONE APPLIED AT A RATE OF 6 TONS PER ACRE (OR 275 POUNDS PER 1,000 SQUARE FEET OF SURFACE AREA) AND COVERED WITH A MINIMUM OF 12 INCHES OF SETTLED SOIL WITH A pH OF 5 OR MORE EXCEPT AS FOLLOWS:

a. AREAS WHERE TREES OR SHRUBS ARE TO BE PLANTED SHALL BE COVERED WITH A MINIMUM OF 24 INCHES OF SOIL WITH A pH OF 5 OR MORE.

b. DISPOSAL AREAS SHALL NOT BE LOCATED WITHIN 24 INCHES OF ANY SURFACE OF A SLOPE OR BANK, SUCH AS BERMS, STREAM BANKS, DITCHES AND OTHERS TO PREVENT POTENTIAL LATERAL LEACHING DAMAGES.

6. EQUIPMENT USED FOR MOVEMENT OF HIGH ACID PRODUCING SOILS SHOULD BE CLEANED AT THE END OF EACH DAY TO PREVENT SPREADING OF HIGH ACID SOIL MATERIALS TO OTHER PARTS OF THE SITE, INTO STREAMS OR STORMWATER CONVEYANCES AND TO PROTECT MACHINERY FROM ACCELERATED RUSTING.

7. NON VEGETATIVE EROSION CONTROL PRACTICES (STONE TRACKING PADS, STRATEGICALLY PLACED LIMESTONE CHECK DAM, SILT FENCE, WOODCHIPS) SHOULD BE INSTALLED TO LIMIT THE MOVEMENT OF HIGH ACID PRODUCING SOILS FROM, AROUND OR OFF THE SITE.

8. FOLLOWING BURIAL OR REMOVAL OF HIGH ACID PRODUCING SOIL, TOPSOILING AND SEEDING OF THE SITE (SEE TEMPORARY VEGETATIVE COVER FOR SOIL STABILIZATION, PERMANENT VEGETATIVE COVER FOR SOIL STABILIZATION, AND TOPSOILING, SAME SHEET) MONITORING SHOULD CONTINUE FOR APPROXIMATELY 6 TO 12 MONTHS TO ASSURE THERE IS ADEQUATE STABILIZATION AND THAT NO SOIL PROBLEMS EMERGE. IF PROBLEMS STILL EXIST THE AFFECTED AREA MUST BE TREATED AS INDICATED ABOVE TO CORRECT THE PROBLEM.

9. MONITORING OF AREAS WHERE HIGH ACID PRODUCING SOIL HAS BEEN PLACED OR BURIED SHOULD BE PERFORMED FOR AT LEAST 2 YEARS OR LONGER IF PROBLEMS OCCUR, TO ASSURE THERE IS NO MIGRATION OF POTENTIAL ACID LEACHATE.

STANDARD FOR DUST CONTROL

DEFINITION

THE CONTROL OF DUST ON CONSTRUCTION SITES AND ROADS.

PURPOSE

TO PREVENT BLOWING AND MOVEMENT OF DUST FROM EXPOSED SOIL SURFACES, REDUCED ON-SITE AND OFF-SITE DAMAGE AND HEALTH HAZARDS, AND IMPROVE TRAFFIC SAFETY.

CONDITION WHERE PRACTICE APPLIES

THIS PRACTICE IS APPLICABLE TO AREAS SUBJECT TO DUST BLOWING AND MOVEMENT WHERE ON-SITE AND OFF-SITE DAMAGE IS LIKELY WITHOUT TREATMENT. CONSULT WITH LOCAL MUNICIPAL ORDINANCES ON ANY RESTRICTIONS.

WATER QUALITY ENHANCEMENT

SEDIMENTS DEPOSITED AS "DUST" ARE OFTEN FINE COLLOIDAL MATERIAL WHICH IS EXTREMELY DIFFICULT TO REMOVE FROM WATER ONCE IT BECOMES SUSPENDED. USE OF THIS STANDARD WILL HELP TO CONTROL THE GENERATION OF DUST FROM CONSTRUCTION SITES AND SUBSEQUENT BLOWING AND DEPOSITION INTO LOCAL SURFACE WATER RESOURCES.

PLANNING CRITERIA

THE FOLLOWING METHODS SHOULD BE CONSIDERED FOR CONTROLLING DUST:
MULCHES - SEE STANDARD OF STABILIZATION WITH MULCHES ONLY, PG. 5-1.
VEGETATIVE COVER - SEE STANDARD FOR: TEMPORARY VEGETATIVE COVER, PG. 7-1, PERMANENT VEGETATIVE COVER FOR SOIL STABILIZATION PG. 4-1, AND PERMANENT STABILIZATION WITH SOD, PG. 6-1.
SPRAY-ON ADHESIVES - ON MINERAL SOILS (NOT EFFECTIVE ON MUCK SOILS). KEEP TRAFFIC OFF THESE AREAS.

TABLE 16-1: DUST CONTROL MATERIALS

MATERIAL	WATER DILUTION	TYPE OF NOZZLE	APPLY GALLONS/ACRE
ANIONIC ASPHALT EMULSION	7:1	COARSE SPRAY	1200
LATEX EMULSION	12:5:1	FINE SPRAY	235
RESIN IN WATER	4:1	FINE SPRAY	300
POLYACRYLAMIDE (PAM) - SPRAY ON POLYACRYLAMIDE (PAM) - DRY SPREAD	APPLY ACCORDING TO MANUFACTURER'S INSTRUCTIONS. MAY ALSO BE USED AS AN ADDITIVE TO SEDIMENT BASINS TO FLOCCULATE AND PRECIPITATE SUSPENDED COLLOIDS. SEE SEDIMENT BASIN STANDARD, P. 26-1		
ACIDULATED SOY BEAN SOAP STICK	NONE	COARSE SPRAY	1200

TILLAGE - TO ROUGHEN SURFACE AND BRING CLODS TO THE SURFACE. THIS IS A TEMPORARY EMERGENCY MEASURE WHICH SHOULD BE USED BEFORE SOIL BLOWING STARTS. BEGIN PLOWING ON WINDWARD SIDE OF SITE. CHISEL-TYPE PLOWS SPACED ABOUT 12 INCHES APART, AND SPRING-TOOTHED HARROWS ARE EXAMPLES OF EQUIPMENT WHICH MAY PRODUCE THE DESIRED EFFECT.
SPRINKLING - SITE IS SPRINKLED UNTIL THE SURFACE IS WET.
BARRIERS - SOLID BOARD FENCES, SNOW FENCES, BURLAP FENCES, CRATE WALLS, BALES OF HAY, AND SIMILAR MATERIAL CAN BE USED TO CONTROL AIR CURRENTS AND SOIL BLOWING.
CALCIUM CHLORIDE - SHALL BE IN FORM OF LOOSE, DRY GRANULES OR FLAKES FINE ENOUGH TO FEED THROUGH COMMONLY USED SPREADERS AT A RATE THAT WILL KEEP SURFACE MOIST BUT NOT CAUSE POLLUTION OR PLANT DAMAGE. IF USED ON STEEPER SLOPES, THEN USE OTHER OTHER PRACTICES TO PREVENT WASHING INTO STREAMS, OR ACCUMULATION AROUND PLANTS.
STONE - COVER SURFACE WITH CRUSHED STONE OR COARSE GRAVEL.

CALL BEFORE YOU DIG!
NEW JERSEY LAW REQUIRES
3 WORKING DAYS NOTICE FOR
CONSTRUCTION PHASE AND 10 WORKING
DAYS IN DESIGN STAGE – STOP CALL
NEW JERSEY ONE CALL SYSTEM, INC.
REFERENCE NEW JERSEY TITLE 48, CHPT. 2, ARTICLE 9
1-800-272-1000

PROJECT NOTES

1. TOPOGRAPHIC SURVEY DATA SHOWN ON THIS PLAN ARE BASED ON FIELD WORK PERFORMED BY J. TIMOTHY KERNAN, INC. FROM NOVEMBER 17, 2010 THRU DECEMBER 9, 2010, OBTAINED IN DIGITAL FORMAT DECEMBER 2010.

2. VERTICAL DATUM IS BASED ON NAVD88, FEET. HORIZONTAL IS BASED ON NAD83, FEET.

3. THE ENTIRE PROJECT AREA IS WITHIN THE 100-YR FLOODPLAIN OF THE MANALAPAN BROOK AS PER THE EFFECTIVE FEMA FLOOD INSURANCE RATE MAP (FIRM), AND THE STATE DELINEATED FLOOD HAZARD AREA (NJFHA). THE ENTIRE PROJECT SITE IS ALSO WITHIN THE 150' RIPARIAN ZONE FOR THE UNNAMED TRIBUTARY TO MANALAPAN BROOK ON WHICH THE PROJECT IS PROPOSED.

4. PROJECT IS LOCATED ENTIRELY WITHIN BLOCK 23, LOT 21.02 (SOUTH OF MONROE BOULEVARD). AUTHORIZATION FROM THE LANDOWNER WILL BE REQUIRED PRIOR TO PERMITTING AND IMPLEMENTATION OF CONSTRUCTION.

5. ADDITIONAL DIGITAL PROPERTY BOUNDARY/EASEMENT INFORMATION WAS NOT AVAILABLE AT THE TIME OF PLAN PREPARATION. THIS INFORMATION WILL BE REQUIRED FOR PERMIT SUBMISSION.

6. NO WETLAND DELINEATION, OR ANY OTHER REGULATORY BOUNDARY DELINEATION HAS BEEN COMPLETED FOR THIS PROJECT AT THE TIME OF PLAN PREPARATION. THIS INFORMATION WILL BE REQUIRED FOR PERMIT SUBMISSION.

7. EXISTING MONROE BOULEVARD CULVERT (IDENTIFIED AS #5C81 BY MIDDLESEX COUNTY) AT THIS LOCATION IS CURRENTLY UNDER DESIGN FOR REPLACEMENT BY DELAWARE RARITAN ENGINEERING. FOR LATEST INFORMATION REGARDING STATUS OF THE CULVERT REPLACEMENT PROJECT, RON SENDNER OF MIDDLESEX COUNTY ENGINEERING DEPARTMENT CAN BE CONTACTED AT (732) 745-3248.

DATE	DESCRIPTION

REVISIONS

STATE OF NEW JERSEY CERTIFICATE OF AUTH. NO.: 24GA27976800

JACOB E. HELMINIAK
Professional Engineer
NJ Lic. No. GE-46967

DATE

PRINCETON HYDRO, LLC
SCIENTISTS AND ENGINEERS
120 EAST UWCHLAN AVENUE
SUITE 204
EXTON, PENNSYLVANIA 19341
PHONE. 610.524.4220
FAX. 610.514.9434
WWW.PRINCETONHYDRO.COM

PROJECT NAME/LOCATION:
STREAMBANK STABILIZATION AND
FLOODPLAIN RESTORATION -- STATION #48
TOWNSHIP OF MONROE
MIDDLESEX COUNTY, NEW JERSEY

DRAWING NAME:
SOIL EROSION AND
SEDIMENT CONTROL AND
CONSTRUCTION NOTES

DATE:	01/15/2011
PROJECT NO.:	0457.008
SCALE:	AS SHOWN
DRAWN BY:	PW/JH
CHECKED BY:	JH/CE

SHEET NO. 6 OF 6

Drawing name: Q:\0457\0457008\CAD\Station80\80_1_Cover.dwg Plotted on: Feb 21, 2011 - 1:29pm

DRY DETENTION BASIN RETROFIT

AT STATION #80
SWEETMANS LANE
BLOCK 8303 LOT 18.01
MANALAPAN TOWNSHIP
MONMOUTH COUNTY, NEW JERSEY

GENERAL NOTES:

1. ALL ELEVATIONS AND QUANTITIES ARE BASED ON IN-SITU CONDITIONS. ONCE DISTURBED, MATERIAL CONDITIONS CAN VARY SIGNIFICANTLY.
2. THE APPROVAL AND USE OF THESE PLANS ARE FOR THE PROJECT OWNER AS DEPICTED ON THIS SHEET. THIS PLAN IS NOT TO BE UTILIZED IN THE PREPARATION OF ANY OTHER PROJECTS.
3. AS FIELD CONDITIONS MAY REQUIRE MODIFICATIONS TO PROPOSED TOPOGRAPHIC ELEVATIONS AND FACILITY LOCATIONS, THESE PLANS ARE NOT TO BE UTILIZED FOR AS-BUILTS OR FOR PURPOSES OTHER THAN STATED HEREIN.
4. THESE PLANS ARE NOT TO BE UTILIZED FOR CONSTRUCTION, UNTIL ALL REQUIRED LOCAL, STATE, AND FEDERAL PERMITS ARE OBTAINED.

CONSTRUCTION NOTES:

1. SOIL, ROCK, OR OTHER MATERIALS TO BE UTILIZED FOR FILLING OR BACKFILLING SHALL BE APPROVED BY A QUALIFIED GEOTECHNICAL ENGINEER.

2. ALL MATERIALS SHALL CONFORM TO THE LATEST AMERICAN STANDARDS FOR TESTING AND MATERIALS SPECIFICATIONS (ASTM).

3. PROXIMITY OF STOCKPILES TO THE EDGE OF EXCAVATIONS SHALL BE SUCH THAT THE INFLUENCE OF THE STOCKPILE SURCHARGE ON THE MODIFIED OR EXISTING SLOPE IS REDUCED. WHERE POSSIBLE STOCKPILES WILL BE PLACED A DISTANCE FROM THE EDGE OF EXCAVATION EQUAL TO (OR GREATER THAN) THE HEIGHT OF THE EXCAVATION.

4. ALL STOCKPILED MATERIAL PROPOSED FOR USE WILL BE PROTECTED FROM EXCESSIVE LOSS OR GAIN OF MOISTURE USING SECURELY ANCHORED PLASTIC COVERS OR EQUIVALENT METHODS.

5. UTILITIES SHALL BE LOCATED BY THE CONTRACTOR PRIOR TO CONSTRUCTION.

6. NECESSARY PRECAUTIONS SHALL BE TAKEN BY THE CONTRACTOR TO PROTECT EXISTING SERVICES AND MAINS. ANY DAMAGE TO EXISTING SERVICES OR MAINS SHALL BE REPAIRED IMMEDIATELY AT THE CONTRACTOR'S EXPENSE.

7. EXCAVATIONS AND STOCKPILES IN NO WAY SHALL HAVE SLOPES STEEPER THAN 2:1.

8. THE CONTRACTOR SHALL NOTE THAT IN THE CASE OF A DISCREPANCY BETWEEN THE SCALED AND THE FIGURED DIMENSIONS SHOWN ON THESE PLANS, THE FIGURED DIMENSIONS SHALL APPLY.

9. IT SHALL BE DISTINCTLY UNDERSTOOD THAT FAILURE TO MENTION SPECIFICALLY ANY WORK THAT WOULD NORMALLY BE REQUIRED TO COMPLETE THE PROJECT, SHALL NOT RELIEVE THE CONTRACTOR OF RESPONSIBILITY TO PERFORM THE WORK.

10. IT SHALL BE THE CONTRACTORS RESPONSIBILITY TO ASSURE THE ACCURACY OF THE PROPERTY BOUNDARIES.

11. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE REPAIR AND REPLACEMENT OF PROPERTY DAMAGE TO FENCES, SIGNS, STRUCTURES, VEGETATION, IRRIGATION, LANDSCAPING COMPONENTS, AND ANY OTHER PROPERTY ITEMS THAT ARE REMOVED FOR THE PURPOSES OF THE PROJECT LOGISTICS AND ACCIDENTS.

12. ANY EXISTING ASPHALT SURFACES SHALL REMAIN UNDISTURBED. ANY DAMAGE TO THESE ASPHALT SURFACES SHALL BE THE SOLE RESPONSIBILITY OF THE CONTRACTOR AND ALL COSTS FOR REPAIRS SHALL BE BORNE BY THE CONTRACTOR.

13. THE CONTRACTOR SHALL PROVIDE NECESSARY MAINTENANCE AND PROTECTION OF TRAFFIC MEASURES.

CONSTRUCTION SAFETY AND SECURITY:

1. ALL CONSTRUCTION SHALL ADHERE TO OSHA STANDARDS AND REGULATIONS.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PURCHASE AND INSTALLATION OF HIGH VISIBILITY FENCING TO BE PLACED ALONG THE PROJECT PERIMETER WARNING SIGNS SHALL ALSO BE PROVIDED.
3. THE CONTRACTOR SHALL PROVIDE CONSTRUCTION WARNING SIGNS AND TRAFFIC CONTROL AS REQUIRED BY THE NJ DEPARTMENT OF TRANSPORTATION WITH REGARD TO ACCESS OF CONSTRUCTION VEHICLES AND TRUCKS UTILIZING MUNICIPAL OF STATE ROADWAYS.

PREPARED FOR:

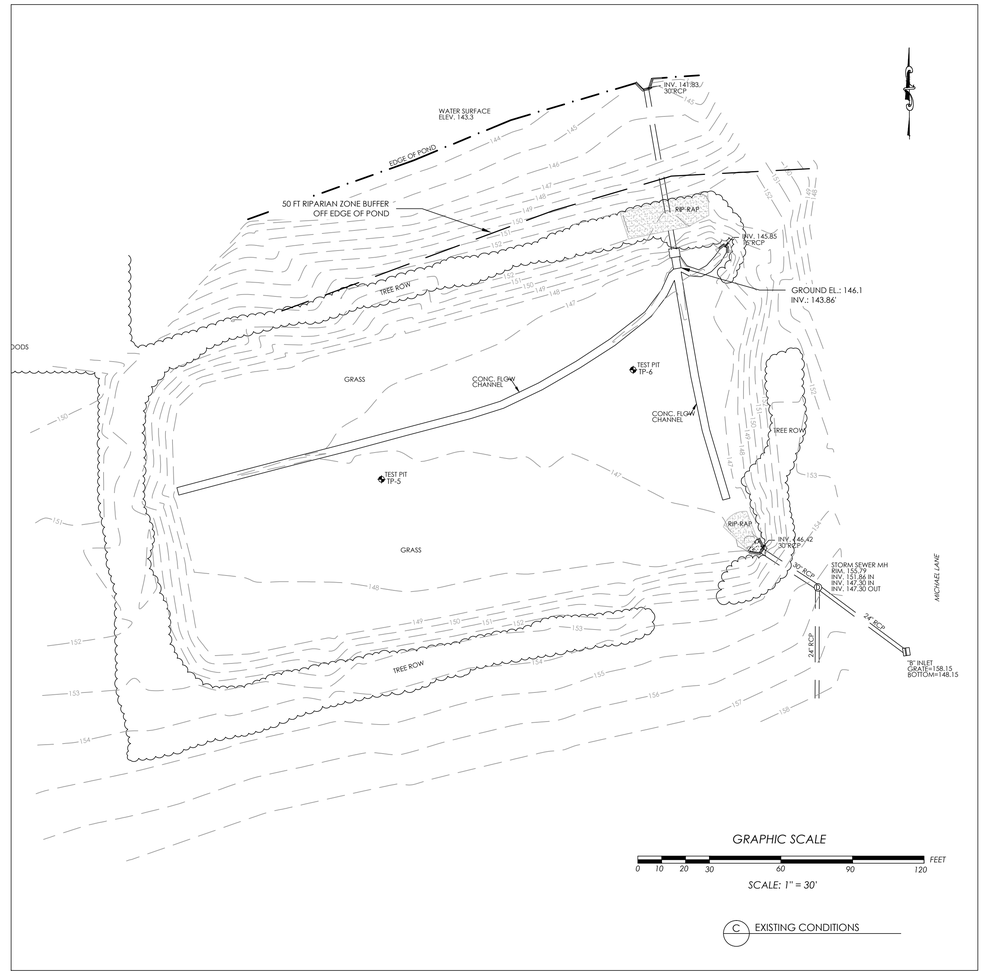
NEW JERSEY WATER SUPPLY AUTHORITY
ON BEHALF OF
THE MANALAPAN BROOK WATERSHED RESTORATION AND PROTECTION PLAN PROJECT COMMITTEE
WATERSHED PROTECTION PROGRAMS
74 EAST MAIN STREET
SOMERVILLE, NJ 08876-2312
P. 908.685.0315

SHEET INDEX:

SHEET 1 - TITLE SHEET AND EXISTING CONDITIONS
SHEET 2 - PROPOSED CONDITIONS & DETAILS
EROSION & SEDIMENT CONTROL PLAN AND DETAILS
SHEET 3 - PLANTING PLAN
SHEET 4 - EROSION AND SEDIMENT CONTROL NOTES

A PROJECT VICINITY
SCALE: 1" = 2000'
USGS QUADRANGLE
7.5 MINUTE SERIES PORTIONS OF
ALDELPHIA AND FREEHOLD, NEW JERSEY
QUADRANGLE

B ORTHOPHOTOGRAPHY
SITE LOCATION
1"=2000'



C EXISTING CONDITIONS

CALL BEFORE YOU DIG!
NEW JERSEY LAW REQUIRES
3 WORKING DAYS NOTICE FOR
CONSTRUCTION PHASE AND 10 WORKING
DAYS IN DESIGN STAGE -- STOP CALL
NEW JERSEY ONE CALL SYSTEM, INC.
REFERENCE NEW JERSEY TITLE 48, CHPT. 2, ARTICLE 9
1-800-272-1000

PROJECT NOTES

GENERAL NOTES:

1. EXISTING CONDITIONS OBTAINED FROM SURVEY COMPLETED BY J. TIMOTHY KERNAN, INC. FROM NOVEMBER 17, 2010 THRU DECEMBER 23, 2010.
2. THE HORIZONTAL DATUM IS NORTH AMERICAN DATUM 1983 (NAD83) NEW JERSEY STATE PLANE (FIPS 2900), UNITS OF FEET.
3. THE VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM 1988 (NAVD88), UNITS OF FEET.
4. NO WETLANDS DELINEATION WAS COMPLETED AS PART OF THIS TOPOGRAPHIC SURVEY. SEE PERMITTING GUIDANCE DOCUMENT.

DATE	DESCRIPTION

REVISIONS

STATE OF NEW JERSEY CERTIFICATE OF AUTH.
NO.: 24GA27976800

KEITHE J. MERL
Professional Engineer
NJ Lic. No. GE44839

DATE

PRINCETON HYDRO, LLC
SCIENTISTS AND ENGINEERS
120 EAST UWCHLAN AVENUE
SUITE 204
EXTON, PENNSYLVANIA 19341
PHONE. 610.524.4220
FAX. 610.514.9434
WWW.PRINCETONHYDRO.COM

PROJECT NAME/LOCATION:
DRY DETENTION BASIN RETROFIT
AT STATION #80
MANALAPAN TOWNSHIP
MONMOUTH COUNTY, NEW JERSEY

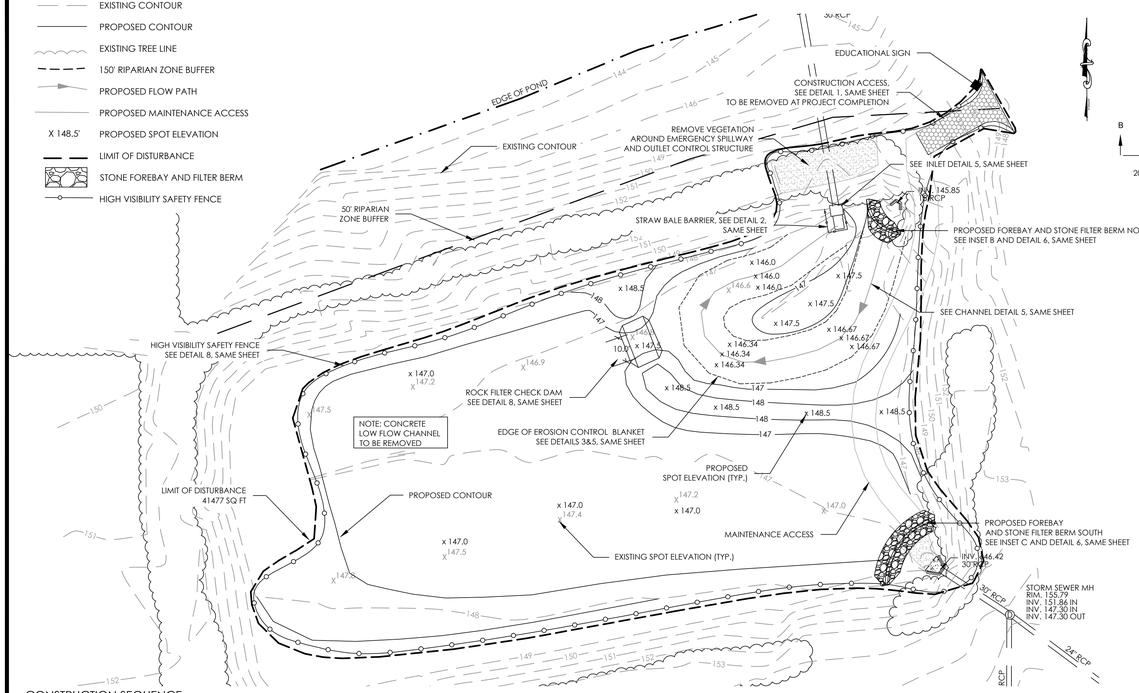
DRAWING NAME:
TITLE SHEET
AND EXISTING CONDITIONS

DATE:	02/28/2011
PROJECT NO.:	0457.008
SCALE:	AS SHOWN
DRAWN BY:	JEO
CHECKED BY:	KJM

SHEET NO.
1 OF 4

LEGEND

- EXISTING CONTOUR
- PROPOSED CONTOUR
- EXISTING TREE LINE
- 150' RIPARIAN ZONE BUFFER
- PROPOSED FLOW PATH
- PROPOSED MAINTENANCE ACCESS
- X 148.5' PROPOSED SPOT ELEVATION
- LIMIT OF DISTURBANCE
- STONE FOREBAY AND FILTER BERM
- HIGH VISIBILITY SAFETY FENCE

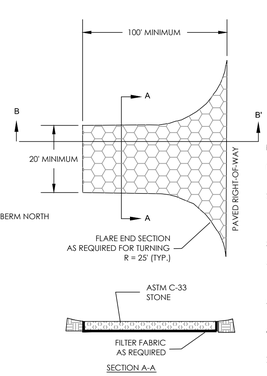


GRAPHIC SCALE

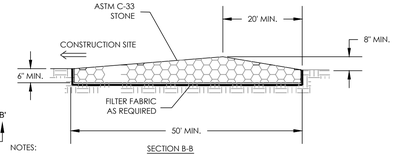
0 10 20 30 60 90 120 FEET

SCALE: 1" = 30'

A PROPOSED CONDITIONS



SECTION A-A

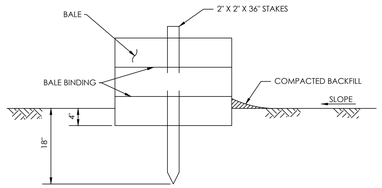


SECTION B-B

NOTES:

1. STABILIZED CONSTRUCTION ENTRANCE WILL BE CONSTRUCTED AS SHOWN ON THE DETAIL.
2. STONE SIZE - ASTM C-33, SIZE NO. 2 OR 3. THE STONE SHALL CONSIST OF CLEAN CRUSHED ANGULAR PARTICLES. RECYCLED CONCRETE OF SIMILAR SIZE MAY BE SUBSTITUTED BUT WILL REQUIRE MORE FREQUENT REPLENISHMENT AND MAINTENANCE.
3. GEOTEXTILE FABRIC SHALL BE USED UNDER THE STONE.
4. THE STRUCTURE'S THICKNESS WILL BE CONSTANTLY MAINTAINED AT THE SPECIFIED DIMENSIONS BY ADDING MATERIAL (SEE NOTE 2) WHEN NECESSARY.
5. ALL SEDIMENT SPILLED, DROPPED, WASHED, OR TRACKED ONTO PUBLIC RIGHTS-OF-WAY MUST BE REMOVED IMMEDIATELY.
6. SITE LIMITATIONS PREVENT INSTALLATION OF THE STABILIZATION CONSTRUCTION ENTRANCE AS PER THE STANDARD (I.E. 100 FEET).
7. CONSTRUCTION ENTRANCE TO BE REMOVED AT PROJECT COMPLETION

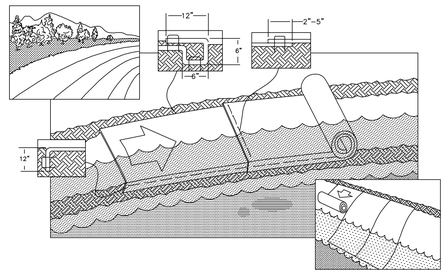
1 ROCK CONSTRUCTION ENTRANCE
NOT TO SCALE



NOTES:

1. STRAW BALE BARRIERS SHOULD NOT BE USED FOR MORE THAN 3 MONTHS.
2. EMBED BALES 4 INCHES AND ANGLE FIRST STAKE TOWARD PREVIOUSLY LAID BALE.
3. STRAW BALE BARRIERS SHALL BE PLACED AT EXISTING LEVEL GRADE. BOTH ENDS OF THE BARRIER SHALL BE EXTENDED SUFFICIENTLY UP THE SLOPE SUCH THAT THE BASE OF THE END BALES IS A MINIMUM OF 18 INCHES ABOVE THE TOP OF THE LOWEST BALE.
4. SEDIMENT SHALL BE REMOVED WHEN ACCUMULATIONS REACH 1/3 THE ABOVE GROUND HEIGHT OF THE BARRIER.
5. ANY SECTION OF STRAW BALE BARRIER WHICH HAS BEEN UNDERMINED OR TOPPED SHALL BE IMMEDIATELY REPLACED WITH A ROCK FILTER OUTLET.

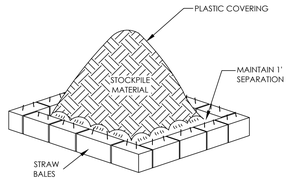
2 STRAW BALE BARRIER
NOT TO SCALE



NOTES:

1. EROSION CONTROL BLANKET SHALL BE COIR MAT 900 OR APPROVED EQUIVALENT
2. STAPLES OR STAKES SHALL BE 6" MINIMUM HEIGHT UNLESS OTHERWISE REQUIRED.
3. PREPARE SOIL (AS PER SEEDING SPECIFICATIONS, SHEET 4 OF 4) BEFORE INSTALLING EROSION CONTROL BLANKETS (ECB'S) INCLUDING ANY NECESSARY APPLICATION OF LIME, FERTILIZER, STRAW AND SEED.
4. BEGIN AT THE TOP OF THE AREA BY ANCHORING THE BLANKET IN A 6" DEEP BY 6" WIDE TRENCH WITH APPROXIMATELY 12" OF EXTENDED BEYOND THE UP-SLOPE PORTION OF THE TRENCH. ANCHOR THE BLANKET WITH A ROW OF STAPLES/STAKES APPROXIMATELY 12" APART IN THE BOTTOM OF THE TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING. APPLY SEED TO COMPACTED SOIL AND FOLD REMAINING 12" PORTION OF ECB BACK OVER SEED AND COMPACTED SOIL. SECURE OVER COMPACTED SOIL WITH A ROW OF STAPLES/STAKES SPACED APPROXIMATELY 12" APART ACROSS THE WIDTH OF THE BLANKET.
5. ROLL ECB'S DOWN THE CHANNEL. ECB'S WILL UNROLL WITH APPROPRIATE SIDE AGAINST THE SOIL SURFACE. ALL ECB'S MUST BE SECURELY FASTENED TO SOIL SURFACE BY PLACING STAPLES/STAKES IN APPROPRIATE LOCATIONS AS SHOWN IN THE STAPLE PATTERN GUIDE.
6. THE EDGES OF ALL HORIZONTAL AND VERTICAL SEAMS MUST BE STAPLED WITH APPROXIMATELY 2"-5" OVERLAP. SEAM OVERLAP SHOULD BE SHINGLED ACCORDING TO PREDOMINANT EROSIVE ACTION.
7. IN LOOSE SOIL CONDITIONS, THE USE OF STAPLE OR STAKE LENGTHS GREATER THAN 6" MAY BE NECESSARY TO PROPERLY ANCHOR THE ECB'S

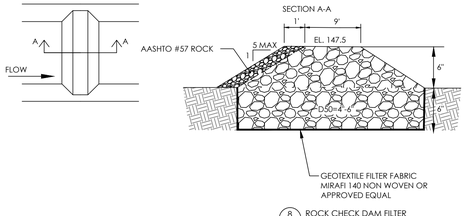
3 EROSION CONTROL BLANKET
NOT TO SCALE



NOTE:

1. UPON PRIOR APPROVAL FROM ENGINEER: SILT FENCING MAY BE SUBSTITUTED FOR STRAW BALES, AND TEMPORARY SEEDING OF STOCKPILES MAY BE SUBSTITUTED FOR PLASTIC COVERING.

4 STOCKPILE CONTROL
NOT TO SCALE



8 ROCK CHECK DAM FILTER
NOT TO SCALE

CONSTRUCTION SEQUENCE

1. INSTALL EROSION AND SEDIMENT CONTROL MEASURES	1 DAY
2. REMOVE CONCRETE LOW FLOW CHANNEL	2 DAYS
3. GRADE AS SHOWN	4 DAYS
4. INSTALL ROCK FILTER CHECK DAM	0.5 DAYS
5. INSTALL SEDIMENT FOREBAY AND STONE FILTER BERM	1 DAY
6. SEED	3 DAYS
7. INSTALL EROSION CONTROL BLANKET	2 DAYS
8. PLANT PLUGS	1 DAY
9. REMOVE EROSION AND SEDIMENT CONTROL MEASURES AND STABILIZED CONSTRUCTION ENTRANCE AFTER BASIN IS COMPLETELY STABILIZED	1 DAY

TOTAL ESTIMATED COMPLETION : 15.5 DAYS

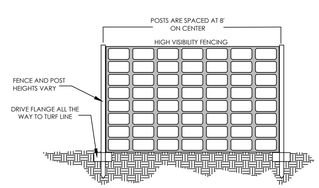
QUANTITIES

QUANTITIES ARE APPROXIMATE

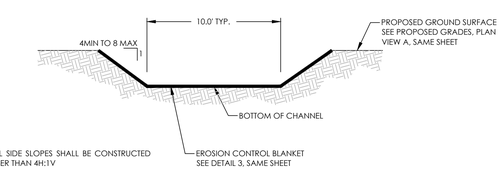
STRAW BALE BARRIER	27 LF
STONE FOR CONSTRUCTON ENTRANCE	9 CY
STONE FOR FOREBAY NORTH	15 CY
STONE FOR FOREBAY SOUTH	26 CY
STONE FOR ROCK FILTER CHECK DAM (4-6" RIP RAP)	4.7 CY
STONE FOR ROCK FILTER CHECK DAM (#57 STONE)	0.25 CY
EROSION CONTROL FABRIC	380 SY
HIGH VISIBILITY SAFETY FENCE	980 LF
CONCRETE LOW FLOW CHANNEL REMOVAL	31.5 CY

CONSTRUCTION NOTES:

1. FINISHED GRADE SHALL INCLUDE A MINIMUM OF 4 INCHES OF VIABLE TOPSOIL FOR PLANTING PURPOSES, CONSISTENT WITH EXISTING CONDITIONS.
2. THE FOLLOWING SEQUENCE OF CONSTRUCTION IS RECOMMENDED:
   - SEGREGATE TOPSOIL FROM AREAS TO BE GRADED
   - GRADE TO 4 INCHES BELOW PROPOSED GRADE ELEVATIONS (AS SHOWN DETAIL A, SAME SHEET)
   - REPLACE 4" OF TOPSOIL TO ACHIEVE FINAL GRADE
3. NO RUBBER TIRE MACHINES TO BE USED, LOW GROUND PRESSURE TRACK MACHINE TO BE USED.



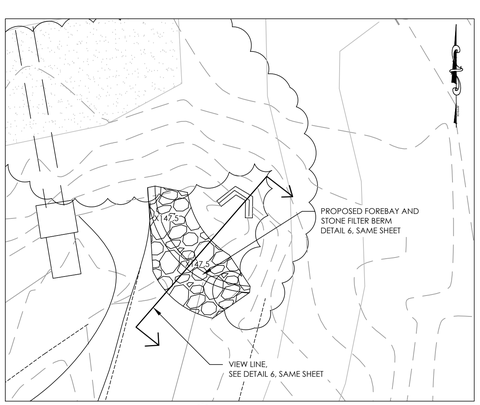
8 HIGH VISIBILITY SAFETY FENCE
NOT TO SCALE



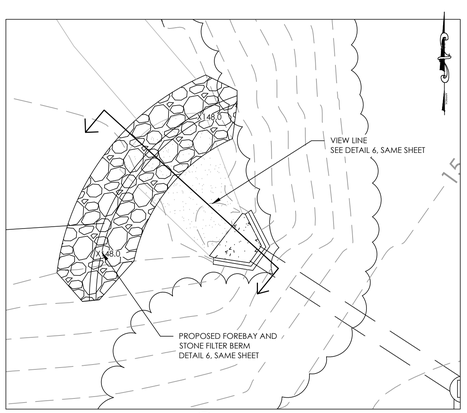
NOTES:

1. CHANNEL SIDE SLOPES SHALL BE CONSTRUCTED NO STEEPER THAN 4H:1V
2. THE TOP WIDTH OF THE CHANNEL WILL VARY BASED ON THE BUILDABLE CHANNEL SIDE SLOPE ANGLE. MINIMUM TOP WIDTH OF THE CHANNEL IS 18'.
3. DEPTH OF CHANNEL IS MINIMUM 0.5 FT AND MAXIMUM 1.0 FT BASED ON PROPOSED GRADES

5 CHANNEL
NOT TO SCALE



B PROPOSED FOREBAY AND STONE FILTER BERM NORTH

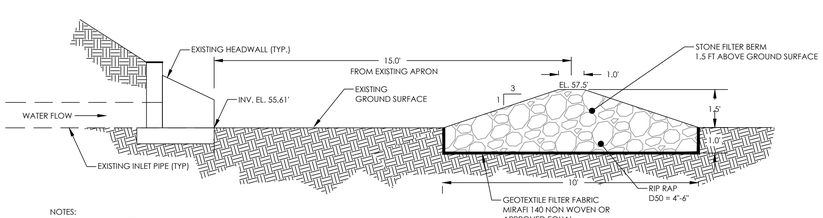


C PROPOSED FOREBAY AND STONE FILTER BERM SOUTH

GRAPHIC SCALE

0 2 4 6 8 10 20 30 40 FEET

SCALE: 1" = 10'



NOTES:

1. TOP WIDTH OF BERM MINIMUM 1.0'
2. MAINTAIN SIDE SLOPES NO STEEPER THAN 3:1 (H:V)
3. STONE FILTER BASE TO BE INSTALLED 1 FOOT BELOW PROPOSED FINAL GRADES

6 FOREBAY AND STONE FILTER BERM
NOT TO SCALE

CALL BEFORE YOU DIG!
NEW JERSEY LAW REQUIRES
3 WORKING DAYS NOTICE FOR CONSTRUCTION PHASE AND 10 WORKING DAYS IN DESIGN STAGE – STOP CALL
NEW JERSEY ONE CALL SYSTEM, INC.
REFERENCE NEW JERSEY TITLE 48, CHPT. 2, ARTICLE 9
1-800-272-1000

PROJECT NOTES

GENERAL NOTES:

1. EXISTING CONDITIONS OBTAINED FROM SURVEY COMPLETED BY J. TIMOTHY KERNAN, INC. FROM NOVEMBER 17, 2010 THRU DECEMBER 23, 2010.
2. THE HORIZONTAL DATUM IS NORTH AMERICAN DATUM 1983 (NAD83) NEW JERSEY STATE PLANE (FIPS 2900), UNITS OF FEET.
3. THE VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM 1988 (NAVD88), UNITS OF FEET.
4. NO WETLANDS DELINEATION WAS COMPLETED AS PART OF THIS TOPOGRAPHIC SURVEY. SEE PERMIT GUIDANCE DOCUMENT

DATE	DESCRIPTION

REVISIONS

STATE OF NEW JERSEY CERTIFICATE OF AUTH. NO.: 24GA27976800

KEITHE J. MERL
Professional Engineer
NJ Lic. No. GE44839

DATE

PRINCETON HYDRO, LLC

SCIENTISTS AND ENGINEERS
120 EAST UWCHLAN AVENUE
SUITE 204
EXTON, PENNSYLVANIA 19341
PHONE. 610.524.4220
FAX. 610.524.9434
WWW.PRINCETONHYDRO.COM

PROJECT NAME/LOCATION:
DRY DETENTION BASIN RETROFIT
AT STATION #80
MANALPAN TOWNSHIP
MONMOUTH COUNTY, NEW JERSEY

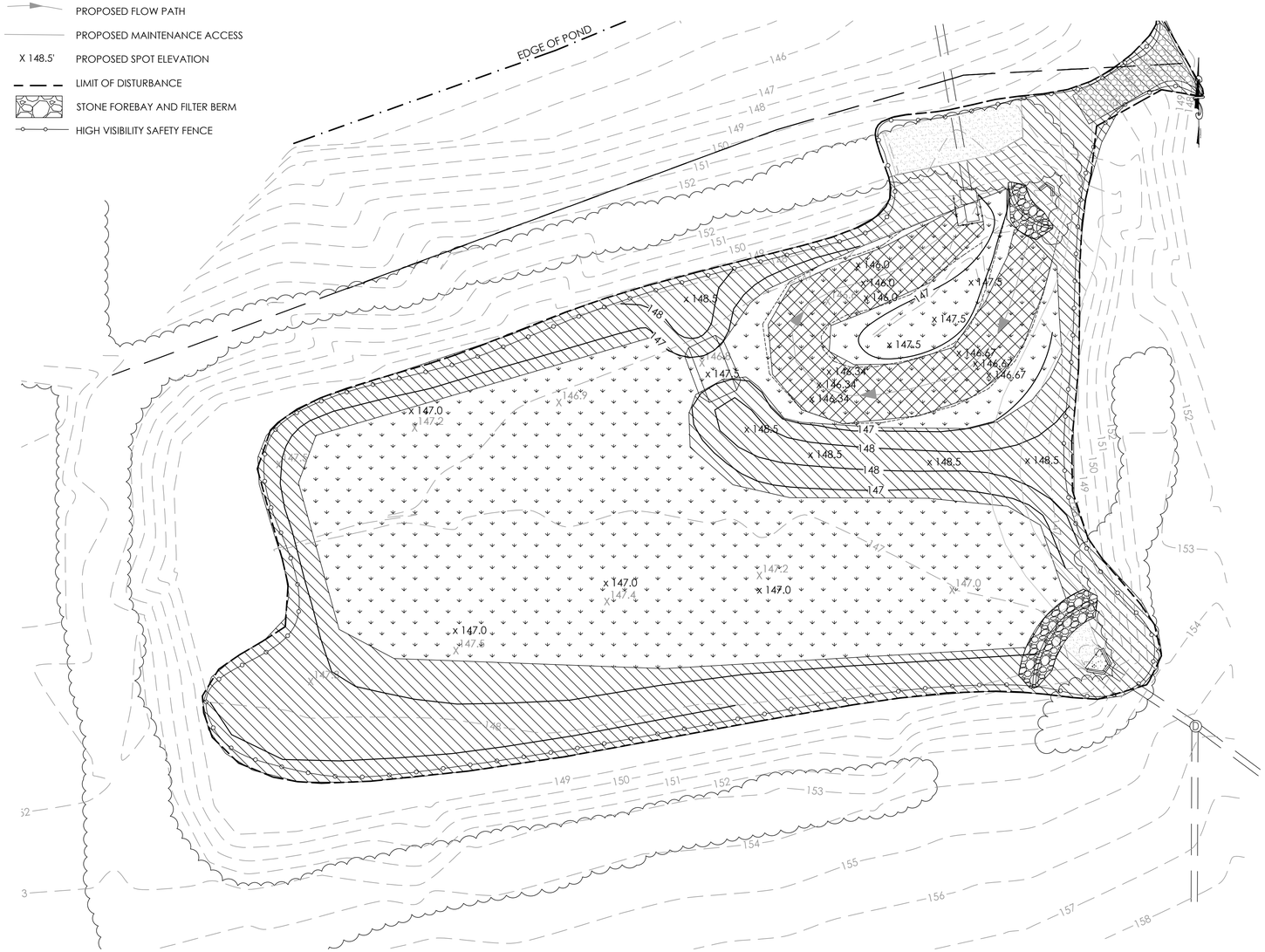
DRAWING NAME:
PROPOSED CONDITIONS & DETAILS
EROSION & SEDIMENT CONTROL
PLAN AND DETAILS

DATE:	01/15/2011
PROJECT NO.:	0457.008
SCALE:	AS SHOWN
DRAWN BY:	JEO
CHECKED BY:	CHE/KJM

SHEET NO.
2 OF 4

LEGEND

- EXISTING CONTOUR
- PROPOSED CONTOUR
- EXISTING TREE LINE
- 150' RIPARIAN ZONE BUFFER
- PROPOSED FLOW PATH
- PROPOSED MAINTENANCE ACCESS
- X 148.5' PROPOSED SPOT ELEVATION
- LIMIT OF DISTURBANCE
- STONE FOREBAY AND FILTER BERM
- HIGH VISIBILITY SAFETY FENCE

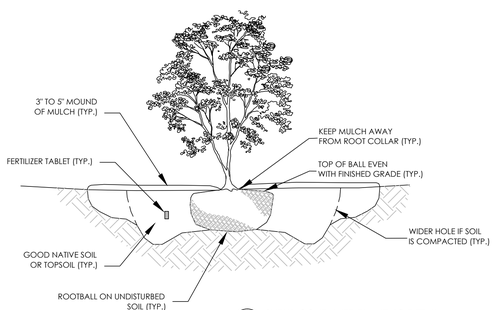


GRAPHIC SCALE

0 5 10 15 20 40 60 80 FEET

SCALE: 1" = 20'

A PLANTING PLAN



2 SHRUB CONTAINER PLANTING DETAIL
NOT TO SCALE

PLANT LIST AND KEY

BOTANICAL NAME	SPECIES NAME	APPROXIMATE RATE (LBS PURE LIVE SEED/ACRE)	INDICATOR STATUS:
WET MEADOW SEED	22,374 SQUARE FEET		
ELYMUS RIPARIUS	RIVERBANK WILD RYE	1/2	FACW
HELENIUM AUTUMNALE	HELEN'S FLOWER	2	FACW+
JUNCUS EFFUSUS	SOFT RUSH	1	FACW+
PANICUM DICHOTOMIFLORUM	SMOOTH PANIC GRASS	5	FACW-
PANICUM VIRGATUM	SWITCH GRASS	3	FAC
POLYGONUM PENSYLVANICUM	PENNSYLVANIA SMARTWEED	2	FACW
SCIRPUS ATROVIRENS	GREEN BULRUSH	2	OBL
VERBENA HASTATA	BLUE VERVAIN	2	FACW+

WET MEADOW PLUGS 3,082 SQUARE FEET

PLANTED IN GROUPS OF FIVE PLUGS PLUGS OF SAME SPECIES. TO BE SPACED THREE (3) FEET ON CENTER WITHIN EACH GROUP.

BOTANICAL NAME	SPECIES NAME	PLANTING TYPE:	INDICATOR STATUS:	QUANTITY:
ASTER NOVI-ANGLIAE	NEW ENGLAND ASTER	PEAT POT/PLUG	FACW	50
EUPATORIUM MACULATUM	SPOTTED JOE PYE	PEAT POT/PLUG	FACW	50
LOBELIA SIPHILITICA	BLUE LOBELIA	PEAT POT/PLUG	FACW+	50

WET AND UPLAND MEADOW TREES 40,139 SQUARE FEET

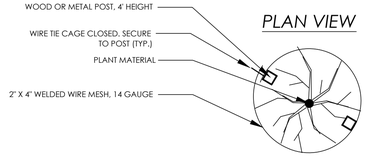
TREES TO BE SPACED IRREGULARLY IN WET AND UPLAND MEADOWS AVOIDING PLUG PLANTING AREA.

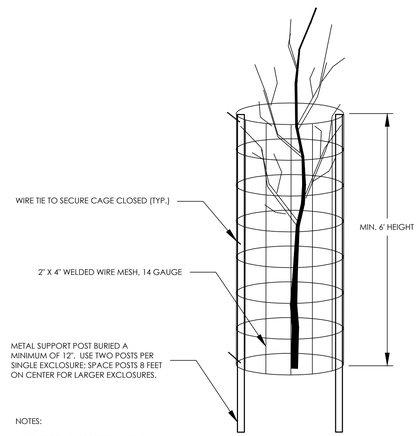
BOTANICAL NAME	SPECIES NAME	PLANTING TYPE:	INDICATOR STATUS:	QUANTITY:
ACER RUBRUM	RED MAPLE	2 GALLON	FAC	20
LIQUIDAMBAR STYRACIFLUA	SWEET GUM	2 GALLON	FAC	20
QUERCUS PALUSTRIS	PIN OAK	3 GALLON	FACW	20
BETULA POPULIFOLIA	GRAY BIRCH	2 GALLON	FAC	20

UPLAND MEADOW SEED 17,765 SQUARE FEET

BOTANICAL NAME	SPECIES NAME	APPROXIMATE RATE (LBS PURE LIVE SEED/ACRE)	INDICATOR STATUS:
ASCLEPIAS SYRIACA	COMMON MILKWEED	1/4	NI
ASTER LATERIFLORUS	CALICO ASTER	1/2	FACW-
CHAMAECRISTA FASCICULATA	PARTIDGE PEA	1	FACU
COREOPSIS LANCEOLATA	LANCE LEAVED COREOPSIS	10	FACU
ELYMUS VIRGINICUS	VIRGINIA WILD RYE	15	FACW-
PANICUM CLANDESTINUM	DEER TONGUE	2	FAC+
PANICUM VIRGATUM	SWITCH GRASS	6	FAC
POLYGONUM PENNSYLVANICUM	PA SMARTWEED	3	FACW
RUDBECKIA TRILOBA	BROWN EYED SUSAN	1/4	FACU
SCHIZACHRYRIUM SCOPARIUM	LITTLE BLUE STEM	6	FACU-
SENNA HEBECARPA	WILD SENNA	10	FAC

PLAN VIEW





NOTES:

1. TO PREVENT DEER BROWSING, INSTALL TREE CAGES AS INDICATED IN DETAIL AROUND ALL TREES.
2. WHERE PRACTICAL, SURROUND CLOSELY GROUPED PLANTS WITH A SINGLE LENGTH OF FENCE.
3. USE (3) WIRE TIES TO FASTEN WIRE FENCE CLOSED.

1 TREE CAGE DETAIL
NOT TO SCALE

CALL BEFORE YOU DIG!
NEW JERSEY LAW REQUIRES
3 WORKING DAYS NOTICE FOR
CONSTRUCTION PHASE AND 10 WORKING
DAYS IN DESIGN STAGE – STOP CALL
NEW JERSEY ONE CALL SYSTEM, INC.
REFERENCE NEW JERSEY TITLE 48, CHPT. 2, ARTICLE 9
1-800-272-1000

PROJECT NOTES

GENERAL NOTES:

1. EXISTING CONDITIONS OBTAINED FROM SURVEY COMPLETED BY J. TIMOTHY KERNAN, INC. FROM NOVEMBER 17, 2010 THRU DECEMBER 9, 2010.
2. THE HORIZONTAL DATUM IS NORTH AMERICAN DATUM 1983 (NAD83) NEW JERSEY STATE PLANE (FIPS 2900), UNITS OF FEET.
3. THE VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM 1988 (NAVD88), UNITS OF FEET.
4. NO WETLANDS DELINEATION WAS COMPLETED AS PART OF THIS TOPOGRAPHIC SURVEY. SEE PERMITTING GUIDANCE DOCUMENT.

DATE	DESCRIPTION

REVISIONS

STATE OF NEW JERSEY CERTIFICATE OF AUTH. NO.: 24GA27976800

KEITHE J. MERL
Professional Engineer
NJ Lic. No. GE44839

DATE

PRINCETON HYDRO, LLC

SCIENTISTS AND ENGINEERS
120 EAST UWCHLAN AVENUE
SUITE 204
EXTON, PENNSYLVANIA 19341
PHONE. 610.524.4220
FAX. 610.524.9434
WWW.PRINCETONHYDRO.COM

PROJECT NAME/LOCATION:
DRY DETENTION BASIN RETROFIT
AT STATION #80
MANALAPAN TOWNSHIP
MONMOUTH COUNTY, NEW JERSEY

DRAWING NAME:
PLANTING PLAN

DATE:	02/28/2011
PROJECT NO.:	0457.008
SCALE:	AS SHOWN
DRAWN BY:	LK
CHECKED BY:	KJM

SHEET NO.
3 OF 4

Drawing name: Q:\0457\0457008\CAD\Station80\80_4_E&S.Notes.dwg   Plotted on: Feb 21, 2011 - 1:35pm

STANDARD FOR PERMANENT VEGETATIVE COVER FOR SOIL STABILIZATION

DEFINITION:
ESTABLISHMENT OF PERMANENT VEGETATIVE COVER ON EXPOSED SOILS WHERE PERENNIAL VEGETATION IS NEEDED FOR LONG TERM PROTECTION.

PURPOSE:
TO PERMANENTLY STABILIZE THE SOIL, ASSURING CONSERVATION OF SOIL AND WATER, AND TO ENHANCE THE ENVIRONMENT.

WATER QUALITY ENHANCEMENT:
SLOWS THE OVERLAND MOVEMENT OF STORMWATER RUNOFF, INCREASES INFILTRATION AND RETAINS SOIL AND NUTRIENTS ON SITE, PROTECTING STREAMS OR OTHER STORMWATER CONVEYANCES.

WHERE APPLICABLE:
ON EXPOSED SOILS

METHODS AND MATERIALS:

1. SITE PREPARATION
   - A. GRADE AS NEEDED AND FEASIBLE TO PERMIT THE USE OF CONVENTIONAL EQUIPMENT FOR SEEDBED PREPARATION, SEEDING, MULCH APPLICATION, AND MULCH ANCHORING. ALL GRADING SHOULD BE DONE IN ACCORDANCE WITH STANDARD FOR LAND GRADING ("STANDARDS FOR SOIL EROSION AND SEDIMENT CONTROL IN NEW JERSEY", THE NEW JERSEY STATE SOIL CONSERVATION COMMITTEE, JULY, 1999, PAGE 19-1.)
   - B. IMMEDIATELY PRIOR TO TOPSOILING, THE SURFACE SHOULD BE SCARIFIED 6 TO 12 INCHES. THIS WILL HELP ENSURE A GOOD BOND BETWEEN THE TOPSOIL AND SUBSOIL.
   - C. EMPLOY NEEDED EROSION CONTROL PRACTICES SUCH AS DIVERSIONS, GRADE STABILIZATION STRUCTURES, CHANNEL STABILIZATION MEASURES, SEDIMENTATION BASINS, AND WATERWAYS. SEE STANDARDS 11 THROUGH 42, "STANDARDS FOR SOIL EROSION AND SEDIMENT CONTROL IN NEW JERSEY", THE NEW JERSEY STATE SOIL CONSERVATION COMMITTEE, JULY 1999.
2. SEEDBED PREPARATION
   - A. APPLY GROUND LIMESTONE AND FERTILIZER ACCORDING TO SOIL TEST RECOMMENDATIONS SUCH AS OFFERED BY RUTGERS CO-OPERATIVE EXTENSION. SOIL SAMPLE MAILERS ARE AVAILABLE FROM THE LOCAL RUTGERS COOPERATIVE EXTENSION OFFICES. FERTILIZER SHALL BE APPLIED AT THE RATE OF 500 POUNDS PER ACRE OR 11 POUNDS PER 1,000 SQUARE FEET OF 10-20-10 OR EQUIVALENT WITH 50% WATER INSOLUBLE NITROGEN UNLESS A SOIL TEST INDICATES OTHERWISE. APPLY LIMESTONE IN ACCORDANCE WITH TABLE 4-1 AND THE RESULTS OF SOIL TESTING. CALCIUM CARBONATE IS THE EQUIVALENT AND STANDARD FOR MEASURING THE ABILITY OF LIMING MATERIALS TO NEUTRALIZE SOIL ACIDITY AND SUPPLY CALCIUM AND MAGNESIUM TO GRASSES AND LEGUMES. TABLE 4-1 IS A GENERAL GUIDELINE FOR LIMESTONE APPLICATION RATES.
   - B. WORK LIME AND FERTILIZER INTO THE SOIL AS NEARLY AS PRACTICAL TO A DEPTH OF 4 INCHES WITH A DISC, SPRINGTOOTH HARROW, OR OTHER SUITABLE EQUIPMENT. THE FINAL HARROWING OR DISCING OPERATION SHOULD BE ON THE GENERAL CONTOUR. CONTINUE TILLAGE UNTIL A REASONABLE UNIFORM SEEDBED IS PREPARED.
   - C. IMMEDIATELY PRIOR TO TOPSOILING, THE SURFACE SHOULD BE SCARIFIED 6 TO 12 INCHES WHERE THERE HAS BEEN SOIL COMPACTION. THIS WILL HELP ENSURE A GOOD BOND BETWEEN THE TOPSOIL AND SUBSOIL.
   - D. A UNIFORM APPLICATION TO A DEPTH OF 5 INCHES (UNSETTLED) IS RECOMMENDED. SOILS WITH A Ph OF 4.0 OR SHALL BE COVERED WITH A MINIMUM DEPTH OF 12 INCHES OF SOIL HAVING A pH OF 5.0 OR MORE, IN ACCORDANCE WITH THE STANDARD FOR MANAGEMENT OF HIGH ACID PRODUCING SOIL, ("STANDARDS FOR SOIL EROSION AND SEDIMENT CONTROL IN NEW JERSEY", THE NEW JERSEY STATE SOIL CONSERVATION COMMITTEE, JULY 1999, PAGE 1-1.)
3. SEEDING
   - A. SEE SHEET 3 OF 4 FOR PERMANENT SEED MIXTURE
     1. SEEDING RATES SPECIFIED ARE REQUIRED WHEN A REPORT OF COMPLIANCE IS REQUESTED PRIOR TO ACTUAL ESTABLISHMENT OF PERMANENT VEGETATION. UP TO 50% REDUCTION IN RATES MAY BE USED WHEN PERMANENT VEGETATION IS ESTABLISHED PRIOR TO A REPORT OF COMPLIANCE INSPECTION. THESE RATES APPLY TO ALL METHODS OF SEEDING. ESTABLISHING PERMANENT VEGETATION MEANS 80% VEGETATIVE COVERAGE WITH THE SPECIFIED SEED MIXTURE FOR THE SEEDBED AREA AND MOWED ONCE.
   - B. **CONVENTIONAL SEEDING** IS PERFORMED BY APPLYING SEED UNIFORMLY BY HAND, CYCLONE (CENTRIFUGAL) SEEDER, DROP SEEDER, DRILL OR CULTIPACKER. EXCEPT FOR DRILLED, HYDROSEEDED OR CULTIPACKED SEEDINGS, SEED SHALL BE INCORPORATED INTO THE SOIL WITHIN 24 HOURS OF SEEDBED PREPARATION TO A DEPTH OF 1/4 TO 1/2 INCH, BY RAKING OR DRAGGING. DEPTH OF SEED PLACEMENT MAY BE 1/4 INCH DEEPER ON COARSE TEXTURED SOIL.
   - C. **HYDROSEEDING** IS A BROADCAST SEEDING METHOD USUALLY INVOLVING A TRUCK OR TRAILER MOUNTED TANK, WITH AN AGITATION SYSTEM AND HYDRAULIC PUMP FOR MIXING SEED, WATER AND FERTILIZER AND SPRAYING THE MIX ONTO THE PREPARED SEEDBED. MULCH **SHALL NOT** BE INCLUDED IN THE TANK WITH SEED. SHORT FIBERED MULCH MAY BE APPLIED WITH A HYDROSEEDER FOLLOWING SEEDING. (ALSO SEE SECTION IV MULCHING BELOW) HYDROSEEDING IS **NOT PREFERRED SEEDING METHOD** BECAUSE SEED AND FERTILIZER ARE APPLIED TO THE SURFACE AND INCORPORATED INTO THE SOIL. POOR SEED TO SOIL CONTACT OCCURS REDUCING SEED GERMINATION AND GROWTH. HYDROSEEDING MAY BE USED FOR AREAS TO STEEP FOR CONVENTIONAL EQUIPMENT TO TRAVERSE OR TOO OBSTRUCTED WITH ROCKS, STUMPS, ETC.
   - D. AFTER SEEDING, FIRMING THE SOIL WITH A CORRUGATED ROLLER WILL ASSURE GOOD SEED TO SOIL CONTACT, RESTORE CAPILLARITY, AND IMPROVE SEEDLING EMERGENCE. **THIS IS THE PREFERRED METHOD**. WHEN PERFORMED ON THE CONTOUR, SHEET EROSION WILL BE MINIMIZED AND WATER CONSERVATION ON SITE WILL BE MAXIMIZED.
4. MULCHING

   MULCHING IS REQUIRED ON ALL SEEDING. MULCH WILL INSURE AGAINST EROSION BEFORE GRASS IS ESTABLISHED AND WILL PROMOTE FASTER AND EARLIER ESTABLISHMENT. THE EXISTENCE OF VEGETATION SUFFICIENT TO CONTROL SOIL EROSION SHALL BE DEEMED IN COMPLIANCE WITH THIS MULCHING REQUIREMENT.
   - A. **STRAW OR HAY.** UNROTTED SMALL GRAIN STRAW, HAY FREE OF SEEDS, OR SALT HAY TO BE APPLIED AT THE RATE OF 1-1/2 TO 2 TONS PER ACRE (70 TO 90 POUNDS PER 1,000 SQUARE FEET), EXCEPT THAT WHERE A CRIMER IS USED INSTEAD OF LIQUID MULCH-BINDER (TACKIFYING OR ADHESIVE AGENT), THE RATE OF APPLICATION IS 3 TONS PER ACRE. MULCH CHOPPER-BLOWERS **MUST NOT** GRIND THE MULCH. HAY MULCH IS NOT RECOMMENDED FOR ESTABLISHING FINE TURF OR LAWNS DUE TO THE PRESENCE OF WEED SEED.

     APPLICATION. SPREAD MULCH UNIFORMLY BY HAND OR MECHANICALLY SO THAT APPROXIMATELY 85% OF THE SOIL SURFACE WILL BE COVERED. FOR UNIFORM DISTRIBUTION OF HAND-SPREAD MULCH, DIVIDE AREA INTO APPROXIMATELY 1,000 SQUARE FEET SECTIONS AND DISTRIBUTE 70 TO 90 POUNDS WITHIN EACH SECTION.

     ANCHORING. ANCHORING SHALL BE ACCOMPLISHED IMMEDIATELY AFTER PLACEMENT TO MINIMIZE LOSS BY WIND AND WATER. THIS MAY BE DONE BY ONE OF THE FOLLOWING METHODS, DEPENDING UPON THE SIZE OF THE AREA, STEEPNESS OF SLOPES, AND COSTS.
     1. PEG AND TWINE. DRIVE 8 TO 10 INCH WOODEN PEGS TO WITHIN 2 TO 3 INCHES OF THE SOIL SURFACE EVERY 4 FEET IN ALL DIRECTIONS. STAKES MAY BE DRIVEN BEFORE OR AFTER APPLYING MULCH. SECURE MULCH TO SOIL SURFACE BY STRETCHING TWINE BETWEEN PEGS IN A CRISS-CROSS AND SQUARE PATTERN. SECURE TWINE AROUND EACH PEG WITH TWO OR MORE TURNS.
     2. MULCH NETTINGS. STAPLE PAPER, JUTE, COTTON, OR PLASTIC NETTINGS TO THE SOIL SURFACE. USE A DEGRADABLE NETTING IN AREAS TO BE MOVED.
     3. CRIMPER (MULCH ANCHORING COULTER TOOL, PREFERRED METHOD). A TRACTOR-DRAWN IMPLEMENT, SOMEWHAT LIKE A DISC HARROW, ESPECIALLY DESIGNED TO PUSH OR CUT SOME OF THE BROADCAST LON FIBER MULCH 3 TO 4 INCHES INTO THE SOIL SO AS TO ANCHOR IT AND LEAVE PART STANDING UPRIGHT. THIS TECHNIQUE IS LIMITED TO AREAS TRAVERSABLE BY A TRACTOR, WHICH MUST OPERATE ON THE CONTOUR OF SLOPES. STRAW MULCH RATE MUST BE 3 TONS PER ACRE. NO ADHESIVE AGENT IS REQUIRED.
     4. LIQUID MULCH BINDERS. MAY BE USED TO ANCHOR SALT HAY, HAY AND STRAW MULCH.
        - a. APPLICATIONS SHOULD BE HEAVIER AT EDGES WHERE WIND MAY CATCH THE MULCH, IN VALLEYS, AND AT CRESTS OF BANKS. THE REMAINDER OF THE AREA SHOULD BE UNIFORM IN APPEARANCE.
        - b. USE ONE OF THE FOLLOWING:
          - (1) ORGANIC AND VEGETABLE BASED BINDERS. NATURALLY OCCURRING, POWDER BASED, HYDROPHILIC MATERIALS WHEN MIXED WITH WATER FORMULATES A GEL AND WHEN APPLIED TO MULCH UNDER SATISFACTORY CURING CONDITIONS WILL FORM MEMBRANED NETWORKS OF INSOLUBLE POLYMERS. THE VEGETABLE GEL SHALL BE PHYSIOLOGICALLY HARMLESS AND NOT RESULT IN A PHYTOTOXIC EFFECT OR IMPEDE GROWTH OF TURFGRASS. USE AT A RATE AND WEATHER CONDITIONS AS RECOMMENDED BY THE MANUFACTURER TO ANCHOR MULCH MATERIALS. **MANY NEW PRODUCTS AREA AVAILABLE, SOME OF WHICH MAY NEED FURTHER EVALUATION FOR USE IN THIS STATE.**
          - (2) SYNTHETIC BINDERS. HIGH POLYMER SYNTHETIC EMULSION, MISCIBLE WITH WATER WHEN DILUTED AND FOLLOWING APPLICATION TO MULCH, DRYING AND CURING SHALL NO LONGER BE SOLUBLE OR DISPERSIBLE IN WATER. IT SHALL BE APPLIED AT RATES RECOMMENDED BY THE MANUFACTURER AND REMAIN TACKY UNTIL GERMINATION OF GRASS.
            NOTE: NAMES GIVEN ABOVE ARE REGISTERED TRADE NAMES. THIS DOES NOT CONSTITUTE A RECOMMENDATION OF THESE PRODUCTS TO THE EXCLUSION OF OTHER PRODUCTS.
   - B. **WOOD FIBER OR PAPER FIBER MULCH.** SHALL BE MADE FROM WOOD, PLANT FIBERS OR PAPER CONTAINING NO GROWTH OR GERMINATION INHIBITING MATERIALS, USED AT THE RATE OF 1,500 POUNDS PER ACRE (OR AS RECOMMENDED BY THE PRODUCT MANUFACTURER) AND MAY BE APPLIED BY A HYDROSEEDER. THIS MULCH SHALL NOT BE MIXED IN THE TANK WITH SEED. USE IS **LIMITED** TO FLATTER SLOPES AND DURING OPTIMUM SEEDING PERIODS IN SPRING AND FALL.
   - C. **PELLETIZED MULCH.** COMPRESSED AND EXTRUDED PAPER AND/OR WOOD FIBER PRODUCT, WHICH MAY CONTAIN CO-POLYMERS, TACKIFIERS, FERTILIZERS AND COLORING AGENTS. THE DRY PELLETS, WHEN APPLIED TO A SEEDED AREA AND WATERED, FORM A MULCH MAT. PELLETIZED MULCH SHALL BE APPLIED IN ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATIONS. MULCH MAY BE APPLIED BY HAND OR MECHANICAL SPREADER AT THE RATE OF 60-75 POUNDS PER 1,000 SQUARE FEET AND ACTIVATED WITH 0.2 TO 0.4 INCHES OF WATER. THIS MATERIAL HAS BEEN FOUND TO BE BENEFICIAL FOR USE ON SMALL LAWN OR RENOVATION AREAS, SEEDED AREAS WHERE WEED-SEED FREE MULCH IS DESIRED OR ON SITES WHERE STRAW MULCH AND TACKIFIER AGENT ARE NOT PRACTICAL OR DESIRABLE. APPLYING THE FULL 0.2 TO 0.4 INCHES OF WATER AFTER SPREADING PELLETIZED MULCH ON THE SEED BED IS EXTREMELY IMPORTANT FOR SUFFICIENT AND EXPANSION OF THE MULCH TO PROVIDE SOIL COVERAGE.

STANDARD FOR PERMANENT VEGETATIVE COVER FOR SOIL STABILIZATION (CONT.)

5. IRRIGATION

   IF SOIL IS DEFICIENT, AND MULCH IS NOT USED, SUPPLY NEW SEEDINGS WITH ADEQUATE WATER (A MINIMUM OF 1/4 INCH TWICE A DAY UNTIL VEGETATION IS WELL ESTABLISHED). THIS IS ESPECIALLY TRUE WHEN SEEDINGS ARE MADE IN ABNORMALLY DRY OR HOT WEATHER OR ON DROUGHTY SITES.
6. TOPDRESSING

   NO FOLLOW-UP OF TOPDRESSING IS MANDATORY. AN EXCEPTION MAY BE WHERE GROSS NITROGEN DEFICIENCY EXISTS TO THE EXTENT THAT TURF FAILURE MAY DEVELOP. IN THAT INSTANCE, TOPDRESS WITH 10-10-10 OR EQUIVALENT AT 400 POUNDS PER 1,000 SQUARE FEET.
7. ESTABLISHING PERMANENT VEGETATIVE STABILIZATION

   THE QUALITY OF PERMANENT VEGETATION RESTS WITH THE CONTRACTOR. THE TIMING OF SEEDING, PREPARATION THE SEEDBED, APPLYING NUTRIENTS, IRRIGATION, MULCH AND OTHER MANAGEMENT ARE ESSENTIAL. THE SEED APPLICATION RATES IN TABLE 4-3 ARE REQUIRED WHEN A **REPORT OF COMPLIANCE** IS REQUESTED PRIOR TO ACTUAL ESTABLISHMENT OF PERMANENT VEGETATION. UP TO 50% REDUCTION IN APPLICATION RATES MAY BE USED WHEN PERMANENT VEGETATION IS ESTABLISHED PRIOR TO REQUESTING A **REPORT OF COMPLIANCE** FROM THE DISTRICT. THESE RATES APPLY TO ALL METHODS OF SEEDING. **ESTABLISHING PERMANENT VEGETATION MEANS 80% VEGETATIVE COVER (OF THE SEEDED SPECIES) AND MOWED ONCE.**

PERMANENT VEGETATIVE SEED MIXTURE FOR SOIL STABILIZATION FOR SOIL DISPOSAL LOCATION

REFER TO SHEET 3 OF 4 FOR PERMANENT SEED MIXTURE AND PLANTING PLAN

STANDARD FOR LAND GRADING

DEFINITION:
RESHAPING THE GROUND SURFACE BY GRADING TO PLANNED ELEVATIONS WHICH ARE DETERMINED BY TOPOGRAPHIC SURVEY AND LAYOUT.

PURPOSE:
IMPROVE SURFACE DRAINAGE AND CONTROL EROSION.

CONDITIONS WHERE PRACTICES APPLIES:
THIS PRACTICE IS APPLICABLE WHERE GRADING TO PLANNED ELEVATIONS IS PRACTICAL AND IT IS DETERMINED THAT GRADING IS NEEDED. GRADING THAT INVOLVES THE DISTURBANCE OF VEGETATION OVER LARGE AREAS SHALL BE AVOIDED. IT MAY BE NECESSARY TO PROVIDE TEMPORARY STABILIZATION OVER LARGE AREAS.

WATER QUALITY ENHANCEMENT:
PROPER GRADING OF DISTURBED SOILS WILL PROTECT AGAINST SOIL LOSS FROM EROSION, ENHANCE ESTABLISHMENT OF PERMANENT VEGETATIVE COVER AND HELP TO PROPERLY MANAGE STORMWATER RUNOFF ALL OF WHICH WILL REDUCE OFFSITE DISCHARGE OF POLLUTANTS.

PLANNING CRITERIA:
EROSION CONTROL MEASURES SHALL BE INSTALLED IN ACCORDANCE WITH THE APPLICABLE STANDARD CONTAINED HEREIN. THE CUT FACE OF EARTH EXCAVATIONS AND FILLS SHALL BE NO STEEPER THAN THE SAFE ANGLE OF REPOSE FOR THE MATERIALS ENCOUNTERED AND FLAT ENOUGH FOR MAINTENANCE AND WILL BE NO GREATER THAN THREE (3) HORIZONTAL TO ONE (1) VERTICAL IN ANY SITUATION. PERMANENTLY EXPOSED FACES OF EARTH CUTS AND FILLS SHALL BE VEGETATED OR OTHERWISE PROTECTED EROSION. PROVISIONS SHALL BE MADE TO SAFELY CONDUCT SURFACE WATER TO STORM DRAINS OR SUITABLE WATER COURSES AND PREVENT SURFACE RUNOFF FROM DAMAGING CUT FACES AND FILL SLOPES. ADJACENT PROPERTIES SHALL BE PROTECTED FROM EXCAVATION AND FILLING OPERATIONS.

STANDARD FOR DUST CONTROL

PURPOSE:
THE CONTROL OF DUST ON CONSTRUCTION SITES AND ROADS.

DEFINITION:
TO PREVENT BLOWING AND MOVEMENT OF DUST FROM EXPOSED SOIL SURFACES, REDUCED ON-SITE AND OFF-SITE DAMAGE AND HEALTH HAZARDS, AND IMPROVE TRAFFIC SAFETY.

WATER QUALITY ENHANCEMENT:
SEDIMENTS DEPOSITED AS "DUST" ARE OFTEN FINE COLLOIDAL MATERIAL WHICH IS EXTREMELY DIFFICULT TO REMOVE FROM WATER ONCE IT BECOMES SUSPENDED. USE OF THIS STANDARD WILL HELP TO CONTROL THE GENERATION OF DUST FROM CONSTRUCTION SITES AND SUBSEQUENT BLOWING AND DEPOSITION INTO LOCAL SURFACE WATER RESOURCES.

CONDITIONS WHERE PRACTICES APPLIES:
THIS PRACTICE IS APPLICABLE TO AREAS SUBJECT TO DUST BLOWING AND MOVEMENT WHERE ON-SITE AND OFF-SITE DAMAGE IS LIKELY WITHOUT TREATMENT. CONSULT WITH LOCAL MUNICIPAL ORDINANCES ON ANY RESTRICTIONS.

THE FOLLOWING METHODS SHOULD BE CONSIDERED FOR CONTROLLING DUST:

SPRAY-ON ADHESIVES: ON MINERAL SOILS (NOT EFFECTIVE ON MUCK SOILS). KEEP TRAFFIC OFF THESE AREAS.

PLANNING CRITERIA:

MATERIAL	WATER DILUTION	TYPE OF NOZZLE	APPLY GALLONS/ACRE
ANIONIC ASPHALT EMULSION	7:1	COARSE SPRAY	1200
LATEX EMULSION	12.5:1	FINE SPRAY	235
RESIN IN WATER	4:1	FINE SPRAY	300
POLYACRYLAMIDE (PAM) - SPRAY ON			
POLYACRYLAMIDE (PAM) - DRY SPREAD			
ACIDEULATED SOY BEAN SOAP STICK	NONE	COARSE SPRAY	1200

APPLY ACCORDING TO MANUFACTURER'S INSTRUCTIONS. MAY ALSO BE USED AS AN ADDITIVE TO SEDIMENT BASINS TO FLOCCULATE AND PRECIPITATE SUSPENDED COLLOIDS.

TILLAGE: TO ROUGHEN SURFACE AND BRING CLODS TO THE SURFACE. THIS IS A TEMPORARY EMERGENCY MEASURE WHICH SHOULD BE USED BEFORE SOIL BLOWING STARTS. BEGIN PLOWING ON WINDWARD SIDE OF SITE. CHISEL-TYPE PLOWS SPACED ABOUT 12 INCHES APART, AND SPRING TOOTHED HARROWS ARE EXAMPLES OF EQUIPMENT WHICH MAY PRODUCE THE DESIRED EFFECT.

SPRINKLING: BROADCAST APPLICATION OF WATER UNTIL THE SURFACE IS WET.

BARRIERS: SOLID BOARD FENCES, SNOW FENCES, BURLAP FENCES, CRATE WALLS, BALES OF HAY, AND SIMILAR MATERIAL CAN BE USED TO CONTROL AIR CURRENTS AND SOIL BLOWING.

CALCIUM CHLORIDE: SHALL BE IN THE FORM OF LOOSE, DRY GRANULES OR FLAKES FINE ENOUGH TO FEED THROUGH COMMONLY USED SPREADERS AT A RATE THAT WILL KEEP SURFACE MOIST BUT NOT CAUSE POLLUTION OR PLANT DAMAGE. IF USED ON STEEPER SLOPES, THEN USE OTHER PRACTICES TO PREVENT WASHING INTO STREAMS, OR ACCUMULATION AROUND PLANTS. NOT TO BE USED IN RETROFIT AREA, APPLICABLE ONLY TO UPLAND AREAS

STONE: COVER SURFACE WITH CRUSHED STONE OR COARSE GRAVEL.

TABLE 4-1

LIMESTONE[1] APPLICATION RATE BY SOIL TEXTURE	
SOIL TEXTURE	TONS / ACRE
CLAY, CLAY LOAM, AND HIGH ORGANIC SOIL	3
SANDY LOAM, LOAM, SILT LOAM	2
LOAMY SAND, SAND	1

1 PULVERIZED DOLOMITIC LIMESTONE IS PREFERRED FOR MOST SOILS SOUTH OF THE NEW BRUNSWICK - TRENTON LINE.

STANDARD FOR MANAGEMENT OF HIGH ACID PRODUCING SOILS

DEFINITION

IDENTIFYING HIGH ACID PRODUCING SOIL WHICH MAY BE EXPOSED DURING EXCAVATION AND LAND GRADING ACTIVITIES AND PRACTICES FOR ITS BURIAL. HIGH ACID PRODUCING SOILS ARE SOIL WITH A PH OF 4 OR LESS OR CONTAIN IRON SULFIDE.

PURPOSE

TO PREVENT OR LIMIT EXPOSURE, EXPOSURE TIME AND SPREADING BY EQUIPMENT OR RAINFALL ON AND OFF SITE AND MINIMIZE EROSION, SEDIMENTATION AND ACID LEACHATE RELATED DAMAGES.

BY ITS EXPOSURE TO AIR, SOILS CONTAINING IRON SULFIDE, CHARACTERIZED BY PYRITE OR MARCASITE NUGGETS OR GREEN SANDS, CAUSES CHEMICAL OXIDATION TO OCCUR PRODUCING SULFURIC ACID AND RESULTS IN SOIL PH LEVELS FALLING TO PH 3 AND LOWER. MOST VEGETATION IS INCAPABLE OF GROWTH AT THIS PH LEVEL. ADJACENT LAND AND RECEIVING WATERS WILL BE NEGATIVELY IMPACTED BY THE ACID LEACHATE. CALCIUM CONTAINING MATERIALS SUCH AS SIDEWALKS, CULVERTS AND OTHER STRUCTURES AND SOME METALLIC MATERIALS ARE ALSO SUSCEPTIBLE TO DEGRADATION. AGRICULTURAL LIMESTONE MATERIALS APPLIED AT RATES OF 8 TONS PER ACRE HAVE RESULTED IN ONLY A TEMPORARY BUFFERING EFFECT AN "LIMING-ONLY" IS THEREFORE NOT CONSIDERED AN ACCEPTABLE MITIGATION PRACTICE.

WATER QUALITY ENHANCEMENT

PROTECTS ON SITE SOILS AND OFFSITE STREAMS AND LAKES FROM SULFURIC ACID LEACHATE WHICH CREATES SOIL PH CONDITIONS UNSUITABLE FOR GROWTH OF VEGETATION.

WHERE APPLICABLE

THIS PRACTICE IS APPLICABLE TO ANY HIGH ACID PRODUCING SOIL MATERIALS. SUCH MATERIALS HAVE BEEN FOUND IN THE COASTAL PLAIN AREAS OF BURLINGTON, CAMDEN, MERCER, MIDDLESEX, MONMOUTH, OCEAN AND SALEM COUNTIES.

PLANNING CRITERIA

EARLY RECOGNITION AND BURIAL, REMOVAL OR DISPOSAL OF HIGH ACID PRODUCING SOILS IS ESSENTIAL FOR LIMITING THE AMOUNT OF ACIDIC MATERIAL PRODUCED.

REVIEW A SURFACE GEOLOGY MAP FOR THE PROPOSED SITE TO INVESTIGATE THE PRESENCE OF GEOLOGIC FORMATIONS WHICH COMMONLY CONTAIN HIGH ACID PRODUCING DEPOSITS. THE GEOLOGIC FORMATIONS ARE AS FOLLOWS:

ENGLISHTOWN SAND	NAVESINK FORMATION
KIRKWOOD FORMATION	RARITAN FORMATION
MAGOTHY FORMATION	RED BANK SAND
MARSHALLTOWN FORMATION	WOODBURY CLAY
MERCHANTVILLE FORMATION	

CONTACT THE LOCAL SOIL CONSERVATION DISTRICT TO DETERMINE THE HISTORICAL PRESENCE OF HIGH ACID PRODUCING SOILS IN THE VICINITY OF THE PROPOSED SITE.

HIGH ACID PRODUCING SOILS MAY BE PRESENT IN UNDISTURBED SOILS AT VARYING DEPTHS INCLUDING NEAR THE SOIL SURFACE TO EXCAVATIONS OR DEEP DISTURBANCES. ITS PRESENCE ON A SITE MAY BE SIGNIFICANT OR LIMITED IN THE SOIL PROFILE. HIGH ACID PRODUCING SOILS ARE COMMONLY BLACK, DARK BROWN, GRAY OR GREENISH WITH SILVERY PYRITE OR MARCASITE NUGGETS OR FLAKES.

ALTERNATIVELY, SANDY SOILS OF REDDISH, YELLOWISH OR LIGHT TO MEDIUM BROWN SOIL MATERIALS ARE USUALLY FREE OF HIGH ACID PRODUCING DEPOSITS.

METHODS AND MATERIALS

1. LIMIT THE EXCAVATION AREA AND EXPOSURE TIME WHEN HIGH ACID PRODUCING SOILS ARE ENCOUNTERED.
2. TOPSOIL STRIPPED FROM THE SITE SHALL BE STORED SEPARATELY FROM TEMPORARILY STOCKPILED HIGH ACID PRODUCING SOILS.
3. STOCKPILES OF HIGH ACID PRODUCING SOIL SHOULD BE LOCATED ON LEVEL LAND TO MINIMIZE ITS MOVEMENT, ESPECIALLY WHEN THIS MATERIAL HAS HIGH CLAY CONTENT.
4. TEMPORARILY STOCKPILED HIGH ACID PRODUCING SOIL MATERIAL TO BE EXPOSED MORE THAN 30 DAYS SHOULD BE COVERED WITH PROPERLY ANCHORED, HEAVY GRADE SHEETS OF POLYETHYLENE WHERE POSSIBLE. IF NOT POSSIBLE, STOCKPILES SHALL BE COVERED WITH A MINIMUM OF 3 TO 6 INCHES OF WOOD CHIPS TO MINIMIZE EROSION OF THE STOCKPILE. SILT FENCE SHALL BE INSTALLED AT THE TOE OF SLOPE TO CONTAIN MOVEMENT OF THE STOCKPILED MATERIAL. TOPSOIL SHALL NOT BE APPLIED TO THE STOCKPILES TO PREVENT TOPSOIL CONTAMINATION WITH HIGH ACID PRODUCING SOIL.
5. HIGH ACID PRODUCING SOILS WITH A PH OF 4 OR LESS, OR CONTAINING IRON SULFIDE, (INCLUDING BORROW FROM CUTS) SHALL BE ULTIMATELY PLACED OR BURIED WITH LIMESTONE APPLIED AT THE RATE OF 6 TONS PER ACRE (OR 275 POUNDS PER 1,000 SQUARE FEET OF SURFACE AREA) AND COVERED WITH A MINIMUM OF 12 INCHES OF SETTLED SOIL WITH A PH OF 5 OR MORE EXCEPT AS FOLLOWS:
   - a. AREAS WHERE TREES OR SHRUBS ARE TO BE PLANTED SHALL BE COVERED WITH A MINIMUM OF 24 INCHES OF SOIL WITH A PH OF 5 OR MORE.
   - b. DISPOSAL AREAS SHALL NOT BE LOCATED WITHIN 24 INCHES OF ANY SURFACE OF A SLOPE OR BANK, SUCH AS BERMS, STREAM BANKS, DITCHES AND OTHERS TO PREVENT POTENTIAL LATERAL LEACHING DAMAGES.
6. EQUIPMENT USED FOR MOVEMENT OF HIGH ACID PRODUCING SOILS SHOULD BE CLEANED AT THE END OF EACH DAY TO PREVENT SPREADING OF HIGH ACID SOIL MATERIALS TO OTHERS PARTS OF THE SITE, INTO STREAMS OR STORMWATER CONVEYANCES AND TO PROTECT MACHINERY FROM ACCELERATED RUSTING.
7. NON VEGETATIVE EROSION CONTROL PRACTICES (STONE TRACKING PADS, STRATEGICALLY PLACED LIMESTONE CHECK DAM, SILT FENCE, WOOD CHIPS) SHOULD BE INSTALLED TO LIMIT THE MOVEMENT OF HIGH ACID PRODUCING SOILS FROM, AROUND OR OFF THE SITE.
8. FOLLOWING BURIAL OR REMOVAL OF HIGH ACID PRODUCING SOIL, TOPSOILING AND SEEDING OF THE SITE, (SEE TEMPORARY VEGETATIVE COVER FOR SOIL STABILIZATION, PERMANENT VEGETATIVE COVER FOR SOIL STABILIZATION, AND TOPSOILING) MONITORING SHOULD CONTINUE FOR APPROXIMATELY 6 TO 12 MONTHS TO ASSURE THERE IS ADEQUATE STABILIZATION AND THAT NO HIGH ACID SOIL PROBLEMS EMERGE. IF PROBLEMS STILL EXIST THE AFFECTED AREA MUST BE TREATED AS INDICATED ABOVE TO CORRECT THE PROBLEM.
9. MONITORING OF AREAS WHERE HIGH ACID PRODUCING SOIL HAS BEEN PLACED OR BURIED SHOULD BE PERFORMED FOR AT LEAST 2 YEARS OR LONGER IF PROBLEMS OCCUR, TO ASSURE THERE IS NO MIGRATION OF POTENTIAL ACID LEACHATE.

FREEHOLD SOIL EROSION AND SEDIMENT CONTROL NOTES:

1. THE FREEHOLD SOIL CONSERVATION DISTRICT SHALL BE NOTIFIED SEVENTY-TWO (72) HOURS IN ADVANCE OF ANY LAND DISTURBING ACTIVITY.
2. ALL WORK IS TO BE DONE IN ACCORDANCE WITH THE STATE STANDARDS FOR SOIL EROSION AND SEDIMENT CONTROL OF NEW JERSEY.
3. ALL SOIL EROSION AND SEDIMENT CONTROL PRACTICES ARE TO BE INSTALLED PRIOR TO ANY MAJOR SOIL DISTURBANCE, OR IN THEIR PROPER SEQUENCE, AND MAINTAINED UNTIL PERMANENT PROTECTION IS ESTABLISHED.
4. ANY CHANGES TO THE CERTIFIED SOIL EROSION AND SEDIMENT CONTROL PLANS WILL REQUIRE THE SUBMISSION OF REVISED SOIL EROSION AND SEDIMENT CONTROL PLANS TO THE DISTRICT FOR RE-CERTIFICATION. THE REVISED PLANS MUST MEET ALL CURRENT STATE SOIL EROSION AND SEDIMENT CONTROL STANDARDS.
5. IN THAT NJSA 4:24-39 ET. SEQ. REQUIRES THAT NO CERTIFICATES OF OCCUPANCY BE ISSUED BEFORE THE PROVISIONS OF THE CERTIFIED PLAN FOR EROSION CONTROL HAVE BEEN COMPLIED WITH FOR PERMANENT MEASURES. ALL SITE WORK AND ALL WORK AROUND INDIVIDUAL LOTS IN SUBDIVISIONS, WILL HAVE TO BE COMPLETED PRIOR TO THE DISTRICT ISSUING A REPORT OF COMPLIANCE FOR THE ISSUANCE OF A CERTIFICATE OF OCCUPANCY BY THE MUNICIPALITY.
6. ANY DISTURBED AREAS THAT WILL BE LEFT EXPOSED MORE THAN THIRTY (30) DAYS, AND NOT SUBJECT TO CONSTRUCTION TRAFFIC, WILL IMMEDIATELY RECEIVE A TEMPORARY SEEDING. IF THE SEASON PREVENTS THE ESTABLISHMENT OF TEMPORARY COVER, THE DISTURBED AREAS WILL BE MULCHED WITH STRAW, OR EQUIVALENT MATERIAL, AT A RATE OF 2 TO 2 $\frac{1}{2}$ TONS PER ACRE, ACCORDING TO STATE STANDARD FOR STABILIZATION WITH MULCH ONLY.
7. IMMEDIATELY FOLLOWING INITIAL DISTURBANCE OR ROUGH GRADING, ALL CRITICAL AREAS SUBJECT TO EROSION (I.E. STEEP SLOPES AND ROADWAY EMBANKMENTS) WILL RECEIVE TEMPORARY SEEDING IN COMBINATION WITH STRAW MULCH OR A SUITABLE EQUIVALENT, AT A RATE OF 1 1/2 TO 2 TONS PER ACRE, ACCORDING TO STATE STANDARDS.
8. A SUB-BASE COURSE WILL BE APPLIED IMMEDIATELY FOLLOWING ROUGH GRADING AND INSTALLATION OF IMPROVEMENTS TO STABILIZE STREETS, ROADS, DRIVEWAYS, AND PARKING AREAS. IN AREAS WHERE NO UTILITIES ARE PRESENT, THE SUB-BASE SHALL BE INSTALLED WITHIN FIFTEEN (15) DAYS OF THE PRELIMINARY GRADING.
9. ANY STEEP SLOPES RECEIVING PIPELINE INSTALLATION WILL BE BACKFILLED AND STABILIZED DAILY, AS THE INSTALLATION CONTINUES (I.E. SLOPES GREATER THAN 3:1).
10. THE STANDARD FOR STABILIZED CONSTRUCTION ACCESS REQUIRES THE INSTALLATION OF A PAD OF CLEAN CRUSHED STONE AT POINTS WHERE TRAFFIC WILL BE ACCESSING THE CONSTRUCTION SITE. AFTER INTERIOR ROADWAYS ARE PAVED, INDIVIDUAL LOTS REQUIRE A STABILIZED CONSTRUCTION ENTRANCE CONSISTING OF ONE INCH TO TWO INCH (1"-2") STONE FOR A MINIMUM LENGTH OF TEN FEET (10') EQUAL TO THE LOT ENTRANCE WIDTH. ALL OTHER ACCESS POINTS SHALL BE BLOCKED OFF.
11. ALL SOIL WASHED, DROPPED, SPILLED, OR TRACKED OUTSIDE THE LIMIT OF DISTURBANCE OR ONTO PUBLIC RIGHT-OF-WAYS WILL BE REMOVED IMMEDIATELY.
12. PERMANENT VEGETATION IS TO BE SEEDED OR SODDED ON ALL EXPOSED AREAS WITHIN TEN (10) DAYS AFTER FINAL GRADING.
13. AT THE TIME THAT SITE PREPARATION FOR PERMANENT VEGETATIVE STABILIZATION IS GOING TO BE ACCOMPLISHED, ANY SOIL THAT WILL NOT PROVIDE A SUITABLE ENVIRONMENT TO SUPPORT ADEQUATE VEGETATIVE GROUND COVER SHALL BE REMOVED OR TREATED IN SUCH A WAY THAT IT WILL PERMANENTLY ADJUST THE SOIL CONDITIONS AND RENDER IT SUITABLE FOR VEGETATIVE GROUND COVER. IF THE REMOVAL OR TREATMENT OF THE SOIL WILL NOT PROVIDE SUITABLE CONDITIONS, NON-VEGETATIVE MEANS OF PERMANENT GROUND STABILIZATION WILL HAVE TO BE EMPLOYED.
14. IN ACCORDANCE WITH THE STANDARD FOR MANAGEMENT OF HIGH ACID PRODUCING SOILS, ANY SOIL HAVING A PH OF 4 OR LESS OR CONTAINING IRON SULFIDES SHALL BE COVERED WITH A MINIMUM OF TWELVE (12) INCHES OF SOIL HAVING A PH OF 5 OR MORE PRIOR TO SEEDBED PREPARATION. AREAS WHERE TREES OR SHRUBS ARE TO BE PLANTED SHALL BE COVERED WITH A MINIMUM OF TWENTY- FOUR (24) INCHES OF SOIL HAVING A PH OF 5 OR MORE.
15. CONDUIT OUTLET PROTECTION MUST BE INSTALLED AT ALL REQUIRED OUTFALLS PRIOR TO THE DRAINAGE SYSTEM BECOMING OPERATIONAL.
16. UNFILTERED DEWATERING IS NOT PERMITTED. NECESSARY PRECAUTIONS MUST BE TAKEN DURING ALL DEWATERING OPERATIONS TO MINIMIZE SEDIMENT TRANSFER. ANY DEWATERING METHODS USED MUST BE IN ACCORDANCE WITH THE STANDARD FOR DEWATERING.
17. SHOULD THE CONTROL OF DUST AT THE SITE BE NECESSARY, THE SITE WILL BE SPRINKLED UNTIL THE SURFACE IS WET, TEMPORARY VEGETATIVE COVER SHALL BE ESTABLISHED OR MULCH SHALL BE APPLIED AS REQUIRED BY THE STANDARD FOR DUST CONTROL.
18. STOCKPILE AND STAGING LOCATIONS ESTABLISHED IN THE FIELD SHALL BE PLACED WITHIN THE LIMIT OF DISTURBANCE ACCORDING TO THE CERTIFIED PLAN. STAGING AND STOCKPILES NOT LOCATED WITHIN THE LIMIT OF DISTURBANCE WILL REQUIRE CERTIFICATION OF A REVISED SOIL EROSION AND SEDIMENT CONTROL PLAN. CERTIFICATION OF A NEW SOIL EROSION AND SEDIMENT CONTROL PLAN MAY BE REQUIRED FOR THESE ACTIVITIES IF AN AREA GREATER THAN 5,000 SQUARE FEET IS DISTURBED.
19. ALL SOIL STOCKPILES ARE TO BE TEMPORARILY STABILIZED IN ACCORDANCE WITH SOIL EROSION AND SEDIMENT CONTROL NOTE #6.
20. THE PROPERTY OWNER SHALL BE RESPONSIBLE FOR ANY EROSION OR SEDIMENTATION THAT MAY OCCUR BELOW STORMWATER OUTFALLS OR OFFSITE AS A RESULT OF CONSTRUCTION OF THE PROJECT.

CALL BEFORE YOU DIG!
NEW JERSEY LAW REQUIRES
3 WORKING DAYS NOTICE FOR
CONSTRUCTION PHASE AND 10 WORKING
DAYS IN DESIGN STAGE – STOP CALL
NEW JERSEY ONE CALL SYSTEM, INC.
REFERENCE NEW JERSEY TITLE 48, CHPT. 2, ARTICLE 9
1-800-272-1000

PROJECT NOTES

GENERAL NOTES:

1. 72 HOURS PRIOR TO ANY SOIL DISTURBANCE, NOTICE IN WRITING, SHALL BE GIVEN TO THE FREEHOLD SOIL CONSERVATION DISTRICT

DATE	DESCRIPTION

REVISIONS

STATE OF NEW JERSEY CERTIFICATE OF AUTH. NO.: 24GA27976800

KEITHE J. MERL
Professional Engineer
NJ Lic. No. GE44839

DATE

PRINCETON HYDRO, LLC
SCIENTISTS AND ENGINEERS
120 EAST UWCHLAN AVENUE
SUITE 204
EXTON, PENNSYLVANIA 19341
PHONE. 610.524.4220
FAX. 610.524.9434
WWW.PRINCETONHYDRO.COM

PROJECT NAME/LOCATION:
DRY DETENTION BASIN ROTROFIT
AT STATION #80
MANALAPAN TOWNSHIP
MONMOUTH COUNTY, NEW JERSEY

DRAWING NAME:
EROSION AND
SEDIMENT CONTROL
NOTES

DATE:	02/28/2011
PROJECT NO.:	0457.008
SCALE:	NOT TO SCALE
DRAWN BY:	JEO
CHECKED BY:	KJM

SHEET NO. 4 OF 4

DRY DETENTION BASIN RETROFIT

AT STATION #84
THOMPSON GROVE ROAD
BLOCK 8400 LOT 27
MANALAPAN TOWNSHIP
MONMOUTH COUNTY, NEW JERSEY

GENERAL NOTES:

1. ALL ELEVATIONS AND QUANTITIES ARE BASED ON IN-SITU CONDITIONS. ONCE DISTURBED, MATERIAL CONDITIONS CAN VARY SIGNIFICANTLY.
2. THE APPROVAL AND USE OF THESE PLANS ARE FOR THE PROJECT OWNER AS DEPICTED ON THIS SHEET. THIS PLAN IS NOT TO BE UTILIZED IN THE PREPARATION OF ANY OTHER PROJECTS.
3. AS FIELD CONDITIONS MAY REQUIRE MODIFICATIONS TO PROPOSED TOPOGRAPHIC ELEVATIONS AND FACILITY LOCATIONS, THESE PLANS ARE NOT TO BE UTILIZED FOR AS-BUILTS OR FOR PURPOSES OTHER THAN STATED HEREIN.
4. THESE PLANS ARE NOT TO BE UTILIZED FOR CONSTRUCTION, UNTIL ALL REQUIRED LOCAL, STATE, AND FEDERAL PERMITS ARE OBTAINED.

CONSTRUCTION NOTES:

1. SOIL, ROCK, OR OTHER MATERIALS TO BE UTILIZED FOR FILLING OR BACKFILLING SHALL BE APPROVED BY A QUALIFIED GEOTECHNICAL ENGINEER.
2. ALL MATERIALS SHALL CONFORM TO THE LATEST AMERICAN STANDARDS FOR TESTING AND MATERIALS SPECIFICATIONS (ASTM).
3. PROXIMITY OF STOCKPILES TO THE EDGE OF EXCAVATIONS SHALL BE SUCH THAT THE INFLUENCE OF THE STOCKPILE SURCHARGE ON THE MODIFIED OR EXISTING SLOPE IS REDUCED. WHERE POSSIBLE STOCKPILES WILL BE PLACED A DISTANCE FROM THE EDGE OF EXCAVATION EQUAL TO (OR GREATER THAN) THE HEIGHT OF THE EXCAVATION.
4. ALL STOCKPILED MATERIAL PROPOSED FOR USE WILL BE PROTECTED FROM EXCESSIVE LOSS OR GAIN OF MOISTURE USING SECURELY ANCHORED PLASTIC COVERS OR EQUIVALENT METHODS.
5. UTILITIES SHALL BE LOCATED BY THE CONTRACTOR PRIOR TO CONSTRUCTION.
6. NECESSARY PRECAUTIONS SHALL BE TAKEN BY THE CONTRACTOR TO PROTECT EXISTING SERVICES AND MAINS. ANY DAMAGE TO EXISTING SERVICES OR MAINS SHALL BE REPAIRED IMMEDIATELY AT THE CONTRACTOR'S EXPENSE.
7. EXCAVATIONS AND STOCKPILES IN NO WAY SHALL HAVE SLOPES STEEPER THAN 2:1.
8. THE CONTRACTOR SHALL NOTE THAT IN THE CASE OF A DISCREPANCY BETWEEN THE SCALED AND THE FIGURED DIMENSIONS SHOWN ON THESE PLANS, THE FIGURED DIMENSIONS SHALL APPLY.
9. IT SHALL BE DISTINCTLY UNDERSTOOD THAT FAILURE TO MENTION SPECIFICALLY ANY WORK THAT WOULD NORMALLY BE REQUIRED TO COMPLETE THE PROJECT, SHALL NOT RELIEVE THE CONTRACTOR OF RESPONSIBILITY TO PERFORM THE WORK.
10. IT SHALL BE THE CONTRACTORS RESPONSIBILITY TO ASSURE THE ACCURACY OF THE PROPERTY BOUNDARIES.
11. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE REPAIR AND REPLACEMENT OF PROPERTY DAMAGE TO FENCES, SIGNS, STRUCTURES, VEGETATION, IRRIGATION, LANDSCAPING COMPONENTS, AND ANY OTHER PROPERTY ITEMS THAT ARE REMOVED FOR THE PURPOSES OF THE PROJECT LOGISTICS AND ACCIDENTS.
12. EXISTING ASPHALT SURFACES SHALL REMAIN UNDISTURBED EXCEPT FOR THE PROPOSED WORK AS CALLED FOR ON THESE PLANS. ANY DAMAGE TO THESE ASPHALT SURFACES SHALL BE THE SOLE RESPONSIBILITY OF THE CONTRACTOR AND ALL COSTS FOR REPAIRS SHALL BE BORNE BY THE CONTRACTOR.
13. THE CONTRACTOR SHALL PROVIDE NECESSARY MAINTENANCE AND PROTECTION OF TRAFFIC MEASURES.

CONSTRUCTION SAFETY AND SECURITY:

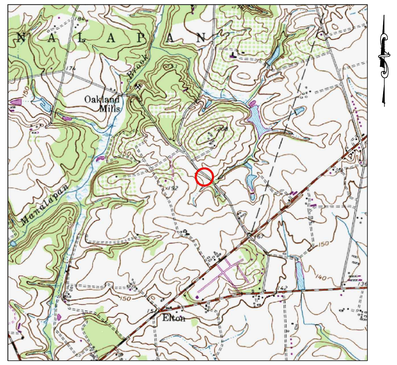
1. ALL CONSTRUCTION SHALL ADHERE TO OSHA STANDARDS AND REGULATIONS.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PURCHASE AND INSTALLATION OF HIGH VISIBILITY FENCING TO BE PLACED ALONG THE PROJECT PERIMETER WARNING SIGNS SHALL ALSO BE PROVIDED.
3. THE CONTRACTOR SHALL PROVIDE CONSTRUCTION WARNING SIGNS AND TRAFFIC CONTROL AS REQUIRED BY THE NJ DEPARTMENT OF TRANSPORTATION WITH REGARD TO ACCESS OF CONSTRUCTION VEHICLES AND TRUCKS UTILIZING MUNICIPAL OF STATE ROADWAYS.

PREPARED FOR:

NEW JERSEY WATER SUPPLY AUTHORITY
ON BEHALF OF
MANALAPAN BROOK WATERSHED RESTORATION AND PROTECTION PLAN PROJECT COMMITTEE
WATERSHED PROTECTION PROGRAMS
74 EAST MAIN STREET
SOMERVILLE, NJ 08876-2312
P. 908.685.0315

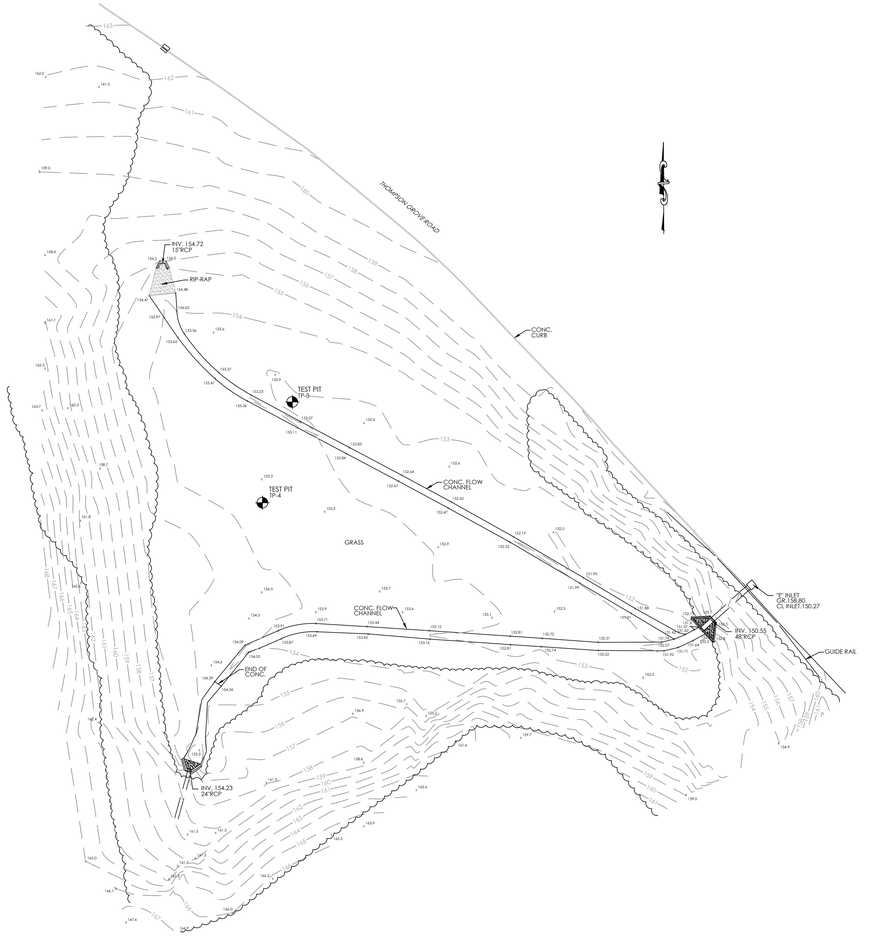
SHEET INDEX:

SHEET 1 - TITLE SHEET AND EXISTING CONDITIONS
SHEET 2 - PROPOSED CONDITIONS & DETAILS AND EROSION & SEDIMENT CONTROL PLAN & DETAILS
SHEET 3 - PLANTING PLAN
SHEET 4 - EROSION AND SEDIMENT CONTROL NOTES



A PROJECT VICINITY
SCALE: 1" = 2000'
USGS QUADRANGLE
7.5 MINUTE SERIES
ALDELPHIA, NEW JERSEY QUADRANGLE

B ORTHOPHOTOGRAPHY
SITE LOCATION
1"=2000'



GRAPHIC SCALE
0 10 20 30 60 90 120 FEET
SCALE: 1" = 30'

C EXISTING CONDITIONS

CALL BEFORE YOU DIG!
NEW JERSEY LAW REQUIRES
3 WORKING DAYS NOTICE FOR
CONSTRUCTION PHASE AND 10 WORKING
DAYS IN DESIGN STAGE -- STOP CALL
NEW JERSEY ONE CALL SYSTEM, INC.
REFERENCE NEW JERSEY TITLE 48, CHPT. 2, ARTICLE 9
1-800-272-1000

PROJECT NOTES

GENERAL NOTES:

1. EXISTING CONDITIONS OBTAINED FROM SURVEY COMPLETED BY J. TIMOTHY KERNAN, INC. FROM NOVEMBER 17, 2010 THRU DECEMBER 23, 2010.
2. THE HORIZONTAL DATUM IS NORTH AMERICAN DATUM 1983 (NAD83) NEW JERSEY STATE PLANE (FIPS 2900), UNITS OF FEET.
3. THE VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM 1988 (NAVD88), UNITS OF FEET.
4. NO WETLANDS DELINEATION WAS COMPLETED AS PART OF THIS TOPOGRAPHIC SURVEY. SEE PERMITTING GUIDANCE DOCUMENT.

DATE	DESCRIPTION

REVISIONS

STATE OF NEW JERSEY CERTIFICATE OF AUTH.
NO.: 24GA27976800

KEITHE J. MERL
Professional Engineer
NJ Lic. No. GE44839

DATE

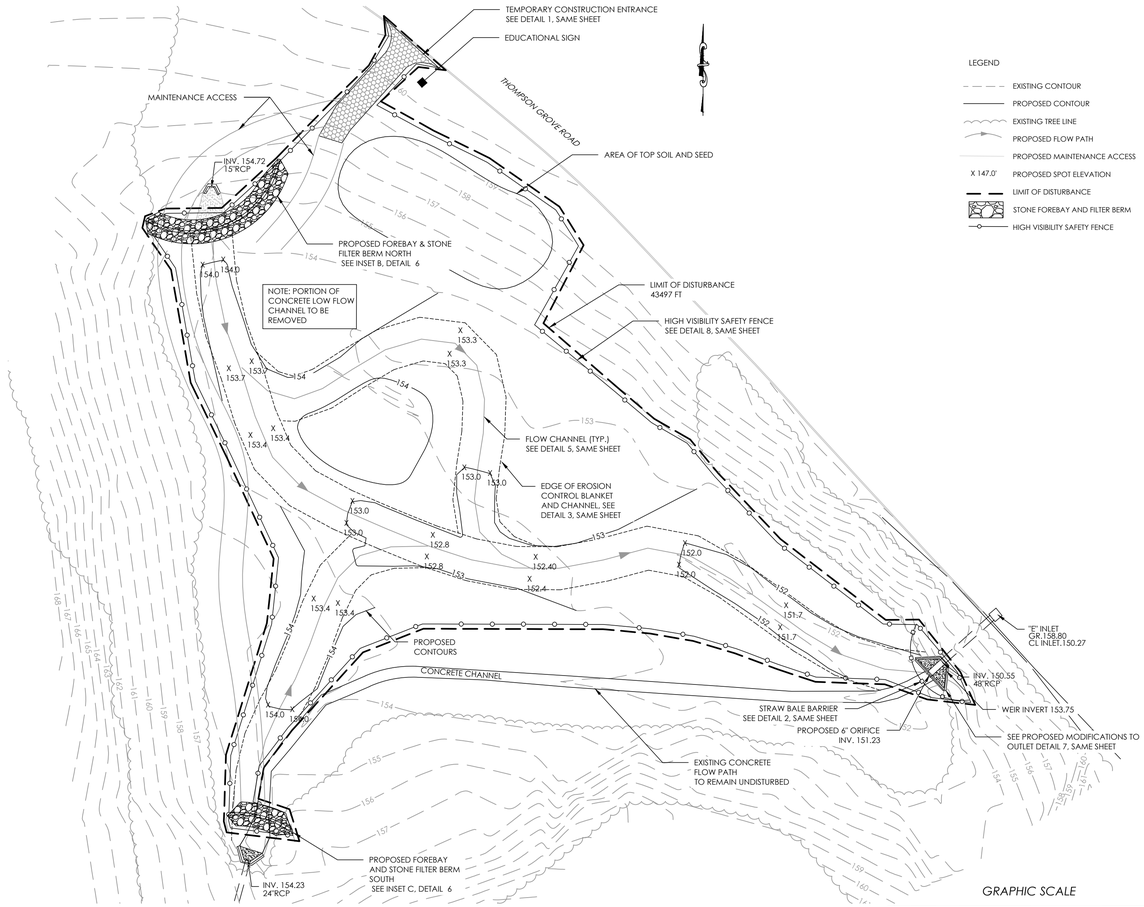
PRINCETON HYDRO, LLC
SCIENTISTS AND ENGINEERS
120 EAST UWCHLAN AVENUE
SUITE 204
EXTON, PENNSYLVANIA 19341
PHONE. 610.524.4220
FAX. 610.514.9434
WWW.PRINCETONHYDRO.COM

PROJECT NAME/LOCATION:
DRY DENTENTION BASIN RETROFIT
AT STATION #84
MANALAPAN TOWNSHIP
MONMOUTH COUNTY, NEW JERSEY

DRAWING NAME:
TITLE SHEET
AND EXISTING CONDITIONS

DATE:	02/28/2011
PROJECT NO.:	0457.008
SCALE:	AS SHOWN
DRAWN BY:	JEO
CHECKED BY:	KJM

SHEET NO.
1 OF 4



LEGEND

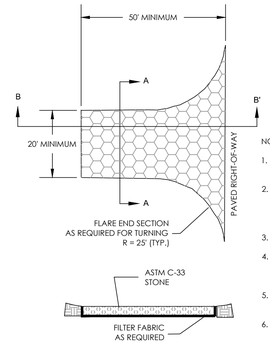
- EXISTING CONTOUR
- PROPOSED CONTOUR
- EXISTING TREE LINE
- PROPOSED FLOW PATH
- PROPOSED MAINTENANCE ACCESS
- X 147.0' PROPOSED SPOT ELEVATION
- LIMIT OF DISTURBANCE
- STONE FOREBAY AND FILTER BERM
- HIGH VISIBILITY SAFETY FENCE

GRAPHIC SCALE

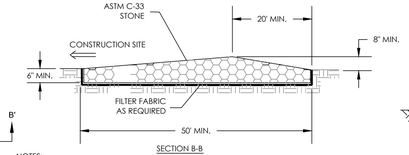
0 10 20 30 60 90 120 FEET

SCALE: 1" = 30'

A PROPOSED CONDITIONS
WITH E&S CONTROLS



SECTION A-A

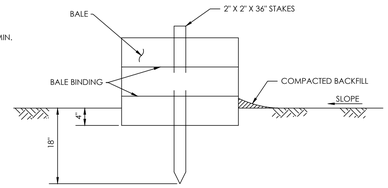


SECTION B-B

NOTES:

1. STABILIZED CONSTRUCTION ENTRANCE WILL BE CONSTRUCTED AS SHOWN ON THE DETAIL.
2. STONE SIZE - ASTM C-33, SIZE NO. 2 OR 3. THE STONE SHALL CONSIST OF CLEAN CRUSHED ANGULAR PARTICLES. RECYCLED CONCRETE OF SIMILAR SIZE MAY BE SUBSTITUTED BUT WILL REQUIRE MORE FREQUENT REPLENISHMENT AND MAINTENANCE.
3. GEOTEXTILE FABRIC SHALL BE USED UNDER THE STONE.
4. THE STRUCTURE'S THICKNESS WILL BE CONSTANTLY MAINTAINED AT THE SPECIFIED DIMENSIONS BY ADDING MATERIAL (SEE NOTE 2) WHEN NECESSARY.
5. ALL SEDIMENT SPILLED, DROPPED, WASHED, OR TRACKED ONTO PUBLIC RIGHTS-OF-WAY MUST BE REMOVED IMMEDIATELY.
6. SITE LIMITATIONS PREVENT INSTALLATION OF THE STABILIZATION CONSTRUCTION ENTRANCE AS PER THE STANDARD (I.E. 100 FEET).
7. STABILIZED CONSTRUCTION ENTRANCE TO BE REMOVED AT PROJECT COMPLETION.

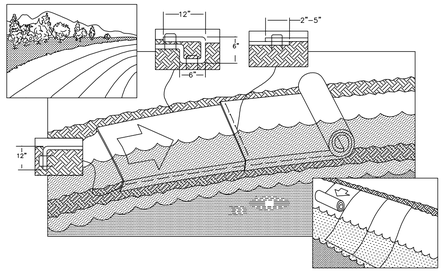
1 STABILIZED CONSTRUCTION ENTRANCE
NOT TO SCALE



NOTES:

1. STRAW BALE BARRIERS SHOULD NOT BE USED FOR MORE THAN 3 MONTHS.
2. EMBED BALES 4 INCHES AND ANGLE FIRST STAKE TOWARD PREVIOUSLY LAID BALE.
3. STRAW BALE BARRIERS SHALL BE PLACED AT EXISTING LEVEL GRADE. BOTH ENDS OF THE BARRIER SHALL BE EXTENDED SUFFICIENTLY UP THE SLOPE SUCH THAT THE BASE OF THE END BALES IS A MINIMUM OF 18 INCHES ABOVE THE TOP OF THE LOWEST BALE.
4. SEDIMENT SHALL BE REMOVED WHEN ACCUMULATIONS REACH 1/3 THE ABOVE GROUND HEIGHT OF THE BARRIER.
5. ANY SECTION OF STRAW BALE BARRIER WHICH HAS BEEN UNDERMINED OR TOPPED SHALL BE IMMEDIATELY REPLACED WITH A ROCK FILTER OUTLET.

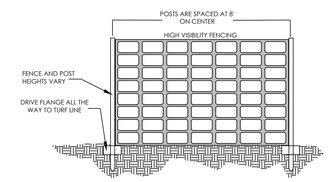
2 STRAW BALE BARRIER
NOT TO SCALE



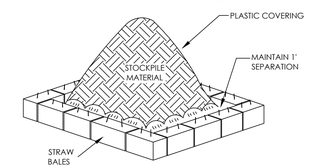
NOTES:

1. EROSION CONTROL BLANKET SHALL BE COIR MAT 900 OR APPROVED EQUIVALENT
2. STAPLES OR STAKES SHALL BE 6" MINIMUM HEIGHT UNLESS OTHERWISE REQUIRED.
3. PREPARE SOIL (AS PER SEEDING SPECIFICATIONS, SHEET 4 OF 4) BEFORE INSTALLING EROSION CONTROL BLANKETS (ECB'S) INCLUDING ANY NECESSARY APPLICATION OF LIME, FERTILIZER, STRAW AND SEED.
4. BEGIN AT THE TOP OF THE AREA BY ANCHORING THE BLANKET IN A 6" DEEP BY 6" WIDE TRENCH WITH MINIMUM 12" OF EXTENDED BEYOND THE UP-SLOPE PORTION OF THE TRENCH. ANCHOR THE BLANKET WITH A ROW OF STAPLES/STAKES APPROXIMATELY 12" APART IN THE BOTTOM OF THE TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING. APPLY SEED TO COMPACTED SOIL AND FOLD REMAINING 12" PORTION OF ECB BACK OVER SEED AND COMPACTED SOIL. SECURE OVER COMPACTED SOIL WITH A ROW OF STAPLES/STAKES SPACED APPROXIMATELY 12" APART ACROSS THE WIDTH OF THE BLANKET.
5. ROLL ECB'S DOWN THE CHANNEL, ECB'S WILL UNROLL WITH APPROPRIATE SIDE AGAINST THE SOIL SURFACE. ALL ECB'S MUST BE SECURELY FASTENED TO SOIL SURFACE BY PLACING STAPLES/STAKES IN APPROPRIATE LOCATIONS AS SHOWN IN THE STAPLE PATTERN GUIDE.
6. THE EDGES OF ALL HORIZONTAL AND VERTICAL SEAMS MUST BE STAPLED WITH APPROXIMATELY 2"-5" OVERLAP. SEAM OVERLAP SHOULD BE SHINGLED ACCORDING TO PREDOMINANT EROSIVE ACTION.
7. IN LOOSE SOIL CONDITIONS, THE USE OF STAPLE OR STAKE LENGTHS GREATER THAN 6" MAY BE NECESSARY TO PROPERLY ANCHOR THE ECB'S

3 EROSION CONTROL BLANKET
NOT TO SCALE



8 HIGH VISIBILITY SAFETY FENCE
NOT TO SCALE



NOTE:

1. UPON PRIOR APPROVAL FROM ENGINEER: SILT FENCING MAY BE SUBSTITUTED FOR STRAW BALES, AND TEMPORARY SEEDING OF STOCKPILES MAY BE SUBSTITUTED FOR PLASTIC COVERING.

4 STOCKPILE CONTROL
NOT TO SCALE

CONSTRUCTION SEQUENCE

1. INSTALL EROSION AND SEDIMENT CONTROL MEASURES — 1 DAY
2. REMOVE CONCRETE LOW FLOW CHANNEL — 2 DAYS
3. GRADE AS SHOWN — 4 DAYS
4. INSTALL SEDIMENT FOREBAY AND STONE FILTER BERM — 1 DAY
5. SEED — 3 DAYS
6. INSTALL EROSION CONTROL BLANKET — 2 DAYS
7. PLANT PLUGS — 1 DAY
8. REMOVE EROSION AND SEDIMENT CONTROL MEASURES AND STABILIZED CONSTRUCTION ENTRANCE AFTER BASIN IS COMPLETELY STABILIZED — 1 DAY

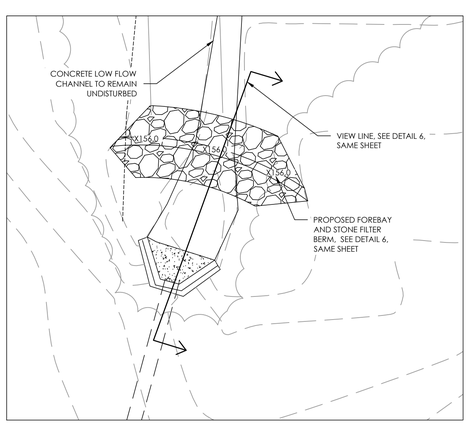
TOTAL: 15 DAYS

QUANTITIES

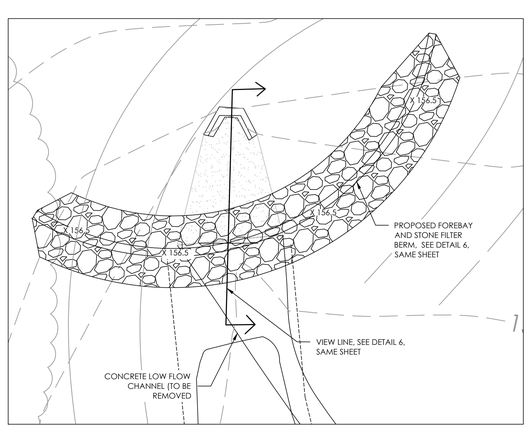
STRAW BALE BARRIER	48 LF
STONE FOR CONSTRUCTION ENTRANCE	11 CY
STONE FOR FOREBAY AND FILTER BERM NORTH	49 CY
STONE FOR FOREBAY AND FILTER BERM SOUTH	20 CY
EROSION CONTROL FABRIC	1536 SY
HIGH VISIBILITY SAFETY FENCE	1217 LF
TOPSOIL	65 CY
CONCRETE LOW FLOW CHANNEL REMOVAL	27 CY

CONSTRUCTION NOTES:

1. FINISHED GRADE SHALL INCLUDE A MINIMUM OF 4 INCHES OF VIABLE TOPSOIL FOR PLANTING PURPOSES, CONSISTENT WITH EXISTING CONDITIONS.
2. THE FOLLOWING SEQUENCE OF CONSTRUCTION IS RECOMMENDED:
   - SEGREGATE TOPSOIL FROM AREAS TO BE GRADED
   - GRADE TO 4 INCHES BELOW PROPOSED GRADE ELEVATIONS (AS SHOWN DETAIL A, SAME SHEET)
   - REPLACE 4" OF TOPSOIL TO ACHIEVE FINAL GRADE
3. NO RUBBER TIRE MACHINES TO BE USED, LOW GROUND PRESSURE TRACK MACHINE TO BE USED.



B PROPOSED FOREBAY AND STONE FILTER BERM SOUTH

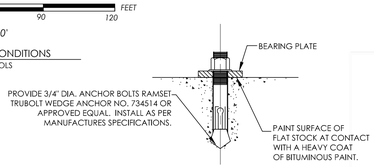


C PROPOSED FOREBAY AND STONE FILTER BERM NORTH

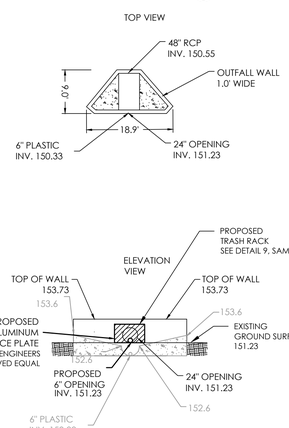
GRAPHIC SCALE

0 2 4 6 8 10 20 30 40 FEET

SCALE: 1" = 10'



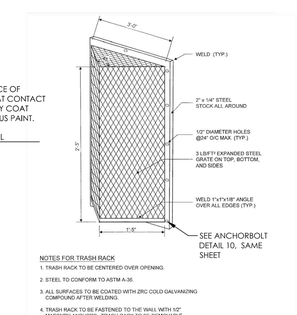
10 ANCHOR BOLT DETAIL
NOT TO SCALE



NOTE:

1. PROPOSED PLATE TO BE MOUNTED TO FACE OF EXISTING OUTLET HEADWALL WITH ANCHOR BOLTS, SEE DETAIL 10, SAME SHEET

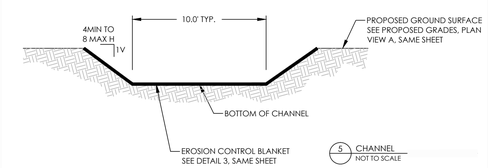
7 OUTLET STRUCTURE
NOT TO SCALE



NOTES FOR TRASH RACK

1. TRASH RACK TO BE CENTERED OVER OPENING.
2. STEEL TO CONFORM TO ASTM A-36.
3. ALL SURFACES TO BE COATED WITH ZRC COLD GALVANIZING COMPOUND AFTER WELDING.
4. TRASH RACK TO BE FASTENED TO THE WALL WITH 1/2" MASONARY ANCHORS. TRASH RACK TO BE REMOVABLE.

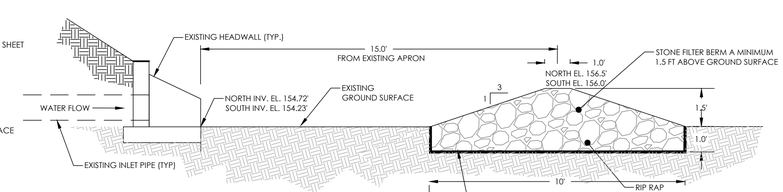
9 ORIFICE TRASH RACK
NOT TO SCALE



NOTES:

1. CHANNEL SIDE SLOPES SHALL BE CONSTRUCTED NO STEEPER THAN 4H:1V
2. THE TOP WIDTH OF THE CHANNEL WILL VARY BASED ON THE BUILDABLE CHANNEL SIDE SLOPE ANGLE. MINIMUM TOP WIDTH OF THE CHANNEL IS 18'.
3. DEPTH OF CHANNEL IS MINIMUM 0.5 FT AND MAXIMUM 1.0 FT BASED ON PROPOSED GRADES

5 CHANNEL
NOT TO SCALE



NOTES:

1. TOP WIDTH OF BERM MINIMUM 1.0'
2. MAINTAIN SIDE SLOPES NO STEEPER THAN 3:1 (H:V)
3. STONE FILTER BASE TO BE INSTALLED 1 FOOT BELOW PROPOSED FINAL GRADES

6 FOREBAY AND STONE FILTER BERM
NOT TO SCALE

CALL BEFORE YOU DIG!
NEW JERSEY LAW REQUIRES
3 WORKING DAYS NOTICE FOR CONSTRUCTION PHASE AND 10 WORKING DAYS IN DESIGN STAGE – STOP CALL
NEW JERSEY ONE CALL SYSTEM, INC.
REFERENCE NEW JERSEY TITLE 48, CHPT. 2, ARTICLE 9
1-800-272-1000

PROJECT NOTES

GENERAL NOTES:

1. EXISTING CONDITIONS OBTAINED FROM SURVEY COMPLETED BY J. TIMOTHY KERNAN, INC. FROM NOVEMBER 17, 2010 THRU DECEMBER 23, 2010.
2. THE HORIZONTAL DATUM IS NORTH AMERICAN DATUM 1983 (NAD83) NEW JERSEY STATE PLANE (FIPS 2900), UNITS OF FEET.
3. THE VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM 1988 (NAVD88), UNITS OF FEET.
4. NO WETLANDS DELINEATION WAS COMPLETED AS PART OF THIS TOPOGRAPHIC SURVEY. SEE PERMITTING GUIDANCE DOCUMENT.

DATE	DESCRIPTION

REVISIONS

STATE OF NEW JERSEY CERTIFICATE OF AUTH. NO.: 24GA27976800

KEITHE J. MERL
Professional Engineer
NJ Lic. No. GE44839

DATE

PRINCETON HYDRO, LLC

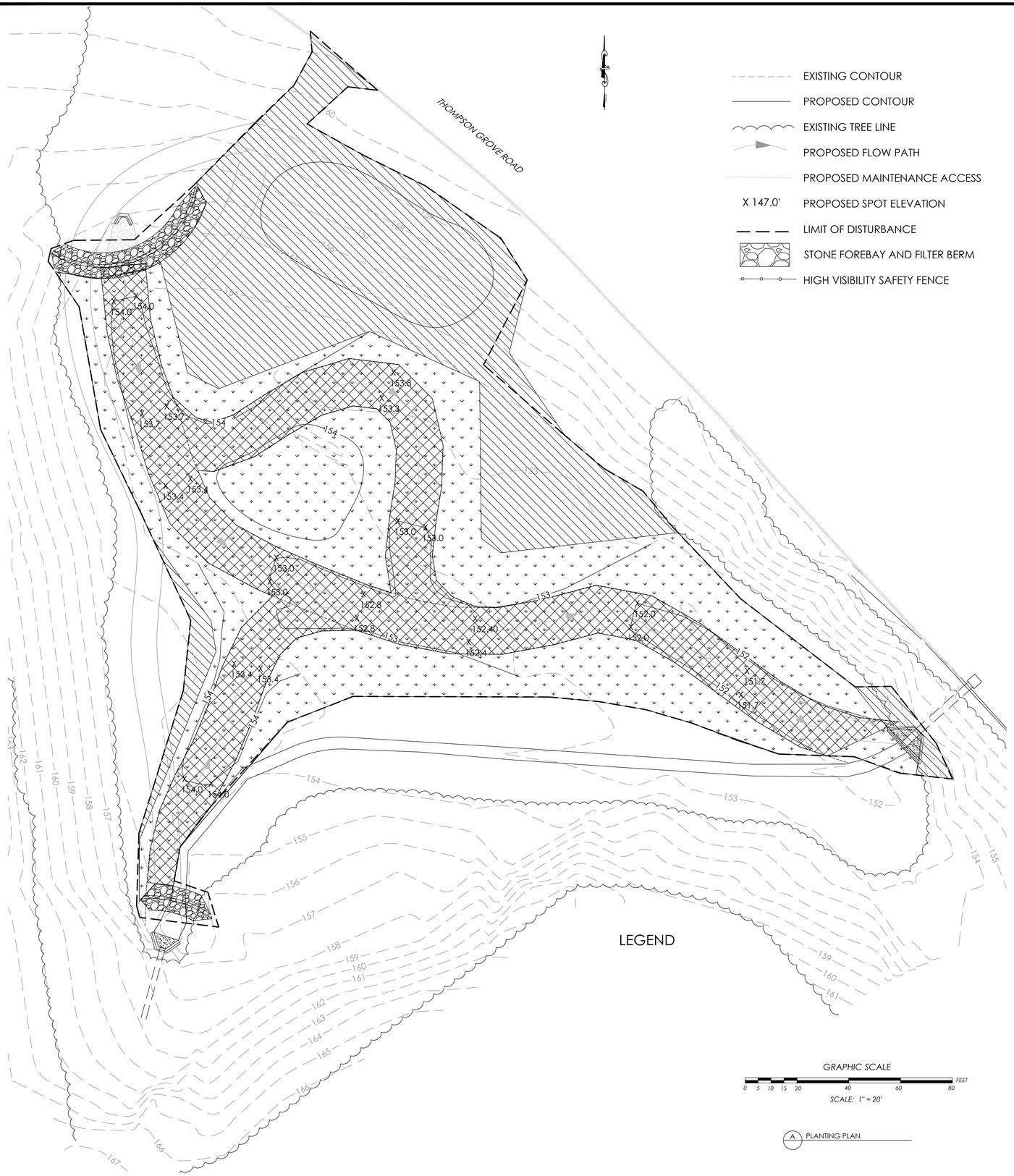
SCIENTISTS AND ENGINEERS
120 EAST UWCHLAN AVENUE
SUITE 204
EXTON, PENNSYLVANIA 19341
PHONE. 610.524.4220
FAX. 610.524.9434
WWW.PRINCETONHYDRO.COM

PROJECT NAME/LOCATION:
DRY DETENTION BASIN RETROFIT
AT STATION #84
MANALAPAN TOWNSHIP
MONMOUTH COUNTY, NEW JERSEY

DRAWING NAME:
PROPOSED CONDITIONS & DETAILS AND EROSION & SEDIMENT CONTROL PLAN & DETAILS

DATE:	02/28/2011
PROJECT NO.:	0457.008
SCALE:	AS SHOWN
DRAWN BY:	JEO
CHECKED BY:	KJM

SHEET NO.
2 OF 4



A PLANTING PLAN

PLANT LIST AND KEY

WET MEADOW SEED — 28,214 SQUARE FEET

BOTANICAL NAME	SPECIES NAME	APPROXIMATE RATE (LBS PER LIVE SEED/ACRE)	INDICATOR STATUS:
ELYMUS RIPARIUS	RIVERBANK WILD RYE	1/2	FACW
HELENIUM AUTUMNALE	HELEN'S FLOWER	2	FACW +
JUNCUS EFFUSUS	SOFT RUSH	1	FACW +
PANICUM DICHOTOMIFLORUM	SMOOTH PANIC GRASS	5	FACW -
PANICUM VIRGATUM	SWITCH GRASS	3	FAC
POLYGONUM PENSYLVANICUM	PENNSYLVANIA SMARTWEED	2	FACW
SCIRPUS ATROVIRENS	GREEN BULRUSH	2	OBL
VERBENA HASTATA	BLUE VERVAIN	2	FACW +

WET MEADOW PLUGS — 12,116 SQUARE FEET

PLANTED IN GROUPS OF FIVE PLUGS PLUGS OF SAME SPECIES. TO BE SPACED THREE (3) FEET ON CENTER WITHIN EACH GROUP.

BOTANICAL NAME	SPECIES NAME	PLANTING TYPE:	INDICATOR STATUS:	QUANTITY:
ASTER NOVI-BELGII	NEW YORK ASTER	PEAT POT/PLUG	FACW +	100
EUPATORIUM PERFOLIATUM	BONSET	PEAT POT/PLUG	FACW +	100
EUPATORIUM MACULATUM	SPOTTED JOE PYE	PEAT POT/PLUG	FACW	100
LOBELIA SIPHILITICA	BLUE LOBELIA	PEAT POT/PLUG	FACW +	100
VERNONIA NOVEBORACENSIS	NEW YORK IRONWEED	PEAT POT/PLUG	FACW +	100

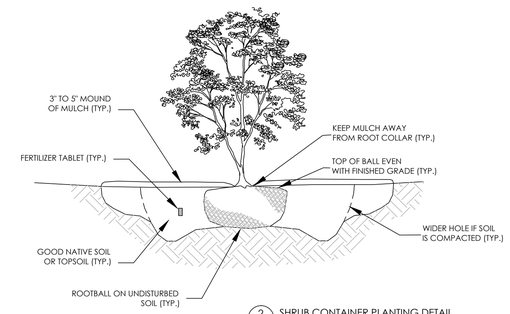
WET MEADOW TREES — 16,098 SQUARE FEET

TREES TO BE SPACED IRREGULARLY IN WET MEADOW AVOIDING PLUG PLANTING AREA.

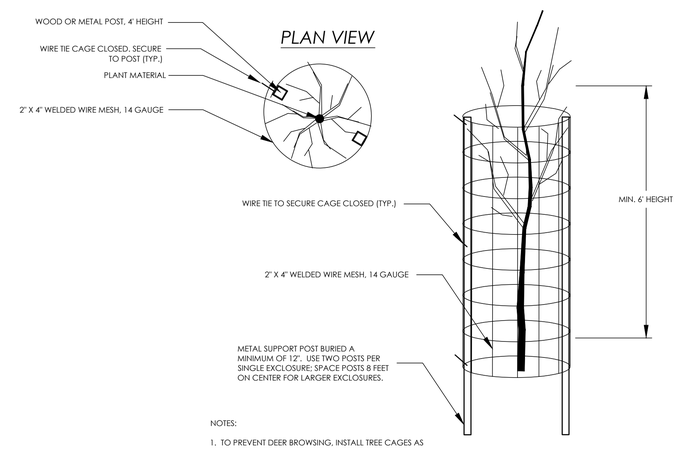
BOTANICAL NAME	SPECIES NAME	PLANTING TYPE:	INDICATOR STATUS:	QUANTITY:
ACER SACCHARINUM	SILVER MAPLE	2 GALLON	FACW	10
BETULA NIGRA	RIVER BIRCH	2 GALLON	FACW	10
QUERCUS BICOLOR	SWAMP WHITE OAK	7 GALLON	FACW +	10

UPLAND MEADOW SEED — 14,396 SQUARE FEET

BOTANICAL NAME	SPECIES NAME	APPROXIMATE RATE (LBS PER LIVE SEED/ACRE)	INDICATOR STATUS:
ASCLEPIAS SYRIACA	COMMON MILKWEED	1/4	NI
ASTER LATERIFLORUS	CALICO ASTER	1/2	FACW -
CHAMAECRISTA FASTICULATA	PARTIDGE PEA	1	FACU
COREOPSIS LANCEOLATA	LANCE LEAVED COREOPSIS	10	FACU
ELYMUS VIRGINICUS	VIRGINIA WILD RYE	15	FACW -
PANICUM CLANDESTINUM	DEER TONGUE	2	FAC+
PANICUM VIRGATUM	SWITCH GRASS	6	FAC
POLYGONUM PENNSYLVANICUM	PA SMARTWEED	3	FACW
RUDBECKIA TRILOBA	BROWN EYED SUSAN	1/4	FACU
SCHIZACHRYRIUM SCOPARIUM	LITTLE BLUE STEM	6	FACU-
SENNA HEBECARPA	WILD SENNA	10	FAC



2 SHRUB CONTAINER PLANTING DETAIL
NOT TO SCALE



NOTES:

1. TO PREVENT DEER BROWSING, INSTALL TREE CAGES AS INDICATED IN DETAIL AROUND ALL PROPOSED TREES.

2. WHERE PRACTICAL, SURROUND CLOSELY GROUPED PLANTS WITH A SINGLE LENGTH OF FENCE.

3. USE (3) WIRE TIES TO FASTEN WIRE FENCE CLOSED.

1 TREE CAGE DETAIL
NOT TO SCALE

CALL BEFORE YOU DIG!
NEW JERSEY LAW REQUIRES
3 WORKING DAYS NOTICE FOR
CONSTRUCTION PHASE AND 10 WORKING
DAYS IN DESIGN STAGE – STOP CALL
NEW JERSEY ONE CALL SYSTEM, INC.
REFERENCE NEW JERSEY TITLE 48, CHPT. 2, ARTICLE 9
1-800-272-1000

PROJECT NOTES

GENERAL NOTES:

1. EXISTING CONDITIONS OBTAINED FROM SURVEY COMPLETED BY J. TIMOTHY KERNAN, INC. FROM NOVEMBER 17, 2010 THRU DECEMBER 23, 2010.
2. THE HORIZONTAL DATUM IS NORTH AMERICAN DATUM 1983 (NAD83) NEW JERSEY STATE PLANE (FIPS 2900), UNITS OF FEET.
3. THE VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM 1988 (NAVD88), UNITS OF FEET.
4. NO WETLANDS DELINEATION WAS COMPLETED AS PART OF THIS TOPOGRAPHIC SURVEY. SEE PERMITTING GUIDANCE DOCUMENT.

DATE	DESCRIPTION

REVISIONS

STATE OF NEW JERSEY CERTIFICATE OF AUTH. NO.: 24GA27976800

KEITHE J. MERL
Professional Engineer
NJ Lic. No. GE44839

DATE

PRINCETON HYDRO, LLC
SCIENTISTS AND ENGINEERS
120 EAST UWCHLAN AVENUE
SUITE 204
EXTON, PENNSYLVANIA 19341
PHONE. 610.524.4220
FAX. 610.524.9434
WWW.PRINCETONHYDRO.COM

PROJECT NAME/LOCATION:
DRY DETENTION BASIN RETROFIT
AT STATION #84
MANALPAN TOWNSHIP
MONMOUTH COUNTY, NEW JERSEY

DRAWING NAME:
PLANTING PLAN

DATE:	02/28/2011
PROJECT NO.:	0457.008
SCALE:	AS SHOWN
DRAWN BY:	JEO
CHECKED BY:	KJM

SHEET NO. 3 OF 4

STANDARD FOR PERMANENT VEGETATIVE COVER FOR SOIL STABILIZATION

DEFINITION:
ESTABLISHMENT OF PERMANENT VEGETATIVE COVER ON EXPOSED SOILS WHERE PERENNIAL VEGETATION IS NEEDED FOR LONG TERM PROTECTION.

PURPOSE:
TO PERMANENTLY STABILIZE THE SOIL, ASSURING CONSERVATION OF SOIL AND WATER, AND TO ENHANCE THE ENVIRONMENT.

WATER QUALITY ENHANCEMENT:
SLOWS THE OVERLAND MOVEMENT OF STORMWATER RUNOFF, INCREASES INFILTRATION AND RETAINS SOIL AND NUTRIENTS ON SITE, PROTECTING STREAMS OR OTHER STORMWATER CONVEYANCES.

WHERE APPLICABLE:
ON EXPOSED SOILS

METHODS AND MATERIALS:

1. SITE PREPARATION
   - A. GRADE AS NEEDED AND FEASIBLE TO PERMIT THE USE OF CONVENTIONAL EQUIPMENT FOR SEEDBED PREPARATION, SEEDING, MULCH APPLICATION, AND MULCH ANCHORING. ALL GRADING SHOULD BE DONE IN ACCORDANCE WITH STANDARD FOR LAND GRADING ("STANDARDS FOR SOIL EROSION AND SEDIMENT CONTROL IN NEW JERSEY", THE NEW JERSEY STATE SOIL CONSERVATION COMMITTEE, JULY, 1999, PAGE 19-1.)
   - B. IMMEDIATELY PRIOR TO TOPSOILING, THE SURFACE SHOULD BE SCARIFIED 6 TO 12 INCHES. THIS WILL HELP ENSURE A GOOD BOND BETWEEN THE TOPSOIL AND SUBSOIL.
   - C. EMPLOY NEEDED EROSION CONTROL PRACTICES SUCH AS DIVERSIONS, GRADE STABILIZATION STRUCTURES, CHANNEL STABILIZATION MEASURES, SEDIMENTATION BASINS, AND WATERWAYS. SEE STANDARDS 11 THROUGH 42, "STANDARDS FOR SOIL EROSION AND SEDIMENT CONTROL IN NEW JERSEY", THE NEW JERSEY STATE SOIL CONSERVATION COMMITTEE, JULY 1999.
2. SEEDBED PREPARATION
   - A. APPLY GROUND LIMESTONE AND FERTILIZER ACCORDING TO SOIL TEST RECOMMENDATIONS SUCH AS OFFERED BY RUTGERS CO-OPERATIVE EXTENSION. SOIL SAMPLE MAILERS ARE AVAILABLE FROM THE LOCAL RUTGERS COOPERATIVE EXTENSION OFFICES. FERTILIZER SHALL BE APPLIED AT THE RATE OF 500 POUNDS PER ACRE OR 11 POUNDS PER 1,000 SQUARE FEET OF 10-20-10 OR EQUIVALENT WITH 50% WATER INSOLUBLE NITROGEN UNLESS A SOIL TEST INDICATES OTHERWISE. APPLY LIMESTONE IN ACCORDANCE WITH TABLE 4-1 AND THE RESULTS OF SOIL TESTING. CALCIUM CARBONATE IS THE EQUIVALENT AND STANDARD FOR MEASURING THE ABILITY OF LIMING MATERIALS TO NEUTRALIZE SOIL ACIDITY AND SUPPLY CALCIUM AND MAGNESIUM TO GRASSES AND LEGUMES. TABLE 4-1 IS A GENERAL GUIDELINE FOR LIMESTONE APPLICATION RATES.
   - B. WORK LIME AND FERTILIZER INTO THE SOIL AS NEARLY AS PRACTICAL TO A DEPTH OF 4 INCHES WITH A DISC, SPRINGTOOTH HARROW, OR OTHER SUITABLE EQUIPMENT. THE FINAL HARROWING OR DISCING OPERATION SHOULD BE ON THE GENERAL CONTOUR. CONTINUE TILLAGE UNTIL A REASONABLE UNIFORM SEEDBED IS PREPARED.
   - C. IMMEDIATELY PRIOR TO TOPSOILING, THE SURFACE SHOULD BE SCARIFIED 6 TO 12 INCHES WHERE THERE HAS BEEN SOIL COMPACTION. THIS WILL HELP ENSURE A GOOD BOND BETWEEN THE TOPSOIL AND SUBSOIL.
   - D. A UNIFORM APPLICATION TO A DEPTH OF 5 INCHES (UNSETTLED) IS RECOMMENDED. SOILS WITH A Ph OF 4.0 OR SHALL BE COVERED WITH A MINIMUM DEPTH OF 12 INCHES OF SOIL HAVING A pH OF 5.0 OR MORE, IN ACCORDANCE WITH THE STANDARD FOR MANAGEMENT OF HIGH ACID PRODUCING SOIL, ("STANDARDS FOR SOIL EROSION AND SEDIMENT CONTROL IN NEW JERSEY", THE NEW JERSEY STATE SOIL CONSERVATION COMMITTEE, JULY 1999, PAGE 1-1.)
3. SEEDING
   - A. SEE SHEET 3 OF 4 FOR PERMANENT SEED MIXTURE
     1. SEEDING RATES SPECIFIED ARE REQUIRED WHEN A REPORT OF COMPLIANCE IS REQUESTED PRIOR TO ACTUAL ESTABLISHMENT OF PERMANENT VEGETATION. UP TO 50% REDUCTION IN RATES MAY BE USED WHEN PERMANENT VEGETATION IS ESTABLISHED PRIOR TO A REPORT OF COMPLIANCE INSPECTION. THESE RATES APPLY TO ALL METHODS OF SEEDING. ESTABLISHING PERMANENT VEGETATION MEANS 80% VEGETATIVE COVERAGE WITH THE SPECIFIED SEED MIXTURE FOR THE SEEDBED AREA AND MOWED ONCE.
   - B. **CONVENTIONAL SEEDING** IS PERFORMED BY APPLYING SEED UNIFORMLY BY HAND, CYCLONE (CENTRIFUGAL) SEEDER, DROP SEEDER, DRILL OR CULTIPACKER. EXCEPT FOR DRILLED, HYDROSEEDED OR CULTIPACKED SEEDINGS, SEED SHALL BE INCORPORATED INTO THE SOIL WITHIN 24 HOURS OF SEEDBED PREPARATION TO A DEPTH OF 1/4 TO 1/2 INCH, BY RAKING OR DRAGGING. DEPTH OF SEED PLACEMENT MAY BE 1/4 INCH DEEPER ON COARSE TEXTURED SOIL.
   - C. **HYDROSEEDING** IS A BROADCAST SEEDING METHOD USUALLY INVOLVING A TRUCK OR TRAILER MOUNTED TANK, WITH AN AGITATION SYSTEM AND HYDRAULIC PUMP FOR MIXING SEED, WATER AND FERTILIZER AND SPRAYING THE MIX ONTO THE PREPARED SEEDBED. MULCH **SHALL NOT** BE INCLUDED IN THE TANK WITH SEED. SHORT FIBERED MULCH MAY BE APPLIED WITH A HYDROSEEDER FOLLOWING SEEDING. (ALSO SEE SECTION IV MULCHING BELOW) HYDROSEEDING IS **NOT PREFERRED SEEDING METHOD** BECAUSE SEED AND FERTILIZER ARE APPLIED TO THE SURFACE AND INCORPORATED INTO THE SOIL. POOR SEED TO SOIL CONTACT OCCURS REDUCING SEED GERMINATION AND GROWTH. HYDROSEEDING MAY BE USED FOR AREAS TO STEEP FOR CONVENTIONAL EQUIPMENT TO TRAVERSE OR TOO OBSTRUCTED WITH ROCKS, STUMPS, ETC.
   - D. AFTER SEEDING, FIRMING THE SOIL WITH A CORRUGATED ROLLER WILL ASSURE GOOD SEED TO SOIL CONTACT, RESTORE CAPILLARITY, AND IMPROVE SEEDLING EMERGENCE. **THIS IS THE PREFERRED METHOD**. WHEN PERFORMED ON THE CONTOUR, SHEET EROSION WILL BE MINIMIZED AND WATER CONSERVATION ON SITE WILL BE MAXIMIZED.
4. MULCHING

   MULCHING IS REQUIRED ON ALL SEEDING. MULCH WILL INSURE AGAINST EROSION BEFORE GRASS IS ESTABLISHED AND WILL PROMOTE FASTER AND EARLIER ESTABLISHMENT. THE EXISTENCE OF VEGETATION SUFFICIENT TO CONTROL SOIL EROSION SHALL BE DEEMED IN COMPLIANCE WITH THIS MULCHING REQUIREMENT.
   - A. **STRAW OR HAY.** UNROTTED SMALL GRAIN STRAW, HAY FREE OF SEEDS, OR SALT HAY TO BE APPLIED AT THE RATE OF 1-1/2 TO 2 TONS PER ACRE (70 TO 90 POUNDS PER 1,000 SQUARE FEET), EXCEPT THAT WHERE A CRIMER IS USED INSTEAD OF LIQUID MULCH-BINDER (TACKIFYING OR ADHESIVE AGENT), THE RATE OF APPLICATION IS 3 TONS PER ACRE. MULCH CHOPPER-BLOWERS **MUST NOT** GRIND THE MULCH. HAY MULCH IS NOT RECOMMENDED FOR ESTABLISHING FINE TURF OR LAWNS DUE TO THE PRESENCE OF WEED SEED.
     APPLICATION. SPREAD MULCH UNIFORMLY BY HAND OR MECHANICALLY SO THAT APPROXIMATELY 85% OF THE SOIL SURFACE WILL BE COVERED. FOR UNIFORM DISTRIBUTION OF HAND-SPREAD MULCH, DIVIDE AREA INTO APPROXIMATELY 1,000 SQUARE FEET SECTIONS AND DISTRIBUTE 70 TO 90 POUNDS WITHIN EACH SECTION.
     ANCHORING. ANCHORING SHALL BE ACCOMPLISHED IMMEDIATELY AFTER PLACEMENT TO MINIMIZE LOSS BY WIND AND WATER. THIS MAY BE DONE BY ONE OF THE FOLLOWING METHODS, DEPENDING UPON THE SIZE OF THE AREA, STEEPNESS OF SLOPES, AND COSTS.
     1. PEG AND TWINE. DRIVE 8 TO 10 INCH WOODEN PEGS TO WITHIN 2 TO 3 INCHES OF THE SOIL SURFACE EVERY 4 FEET IN ALL DIRECTIONS. STAKES MAY BE DRIVEN BEFORE OR AFTER APPLYING MULCH. SECURE MULCH TO SOIL SURFACE BY STRETCHING TWINE BETWEEN PEGS IN A CRISS-CROSS AND SQUARE PATTERN. SECURE TWINE AROUND EACH PEG WITH TWO OR MORE TURNS.
     2. MULCH NETTINGS. STAPLE PAPER, JUTE, COTTON, OR PLASTIC NETTINGS TO THE SOIL SURFACE. USE A DEGRADABLE NETTING IN AREAS TO BE MOVED.
     3. CRIMPER (MULCH ANCHORING COULTER TOOL, PREFERRED METHOD). A TRACTOR-DRAWN IMPLEMENT, SOMEWHAT LIKE A DISC HARROW, ESPECIALLY DESIGNED TO PUSH OR CUT SOME OF THE BROADCAST LON FIBER MULCH 3 TO 4 INCHES INTO THE SOIL SO AS TO ANCHOR IT AND LEAVE PART STANDING UPRIGHT. THIS TECHNIQUE IS LIMITED TO AREAS TRAVERSABLE BY A TRACTOR, WHICH MUST OPERATE ON THE CONTOUR OF SLOPES. STRAW MULCH RATE MUST BE 3 TONS PER ACRE. NO ADHESIVE AGENT IS REQUIRED.
     4. LIQUID MULCH BINDERS. MAY BE USED TO ANCHOR SALT HAY, HAY AND STRAW MULCH.
        - a. APPLICATIONS SHOULD BE HEAVIER AT EDGES WHERE WIND MAY CATCH THE MULCH, IN VALLEYS, AND AT CRESTS OF BANKS. THE REMAINDER OF THE AREA SHOULD BE UNIFORM IN APPEARANCE.
        - b. USE ONE OF THE FOLLOWING:
          - (1) ORGANIC AND VEGETABLE BASED BINDERS. NATURALLY OCCURRING, POWDER BASED, HYDROPHILIC MATERIALS WHEN MIXED WITH WATER FORMULATES A GEL AND WHEN APPLIED TO MULCH UNDER SATISFACTORY CURING CONDITIONS WILL FORM MEMBRANED NETWORKS OF INSOLUBLE POLYMERS. THE VEGETABLE GEL SHALL BE PHYSIOLOGICALLY HARMLESS AND NOT RESULT IN A PHYTOTOXIC EFFECT OR IMPEDE GROWTH OF TURFGRASS. USE AT A RATE AND WEATHER CONDITIONS AS RECOMMENDED BY THE MANUFACTURER TO ANCHOR MULCH MATERIALS. **MANY NEW PRODUCTS AREA AVAILABLE, SOME OF WHICH MAY NEED FURTHER EVALUATION FOR USE IN THIS STATE.**
          - (2) SYNTHETIC BINDERS. HIGH POLYMER SYNTHETIC EMULSION, MISCIBLE WITH WATER WHEN DILUTED AND FOLLOWING APPLICATION TO MULCH, DRYING AND CURING SHALL NO LONGER BE SOLUBLE OR DISPERSIBLE IN WATER. IT SHALL BE APPLIED AT RATES RECOMMENDED BY THE MANUFACTURER AND REMAIN TACKY UNTIL GERMINATION OF GRASS.
            NOTE: NAMES GIVEN ABOVE ARE REGISTERED TRADE NAMES. THIS DOES NOT CONSTITUTE A RECOMMENDATION OF THESE PRODUCTS TO THE EXCLUSION OF OTHER PRODUCTS.
   - B. **WOOD FIBER OR PAPER FIBER MULCH.** SHALL BE MADE FROM WOOD, PLANT FIBERS OR PAPER CONTAINING NO GROWTH OR GERMINATION INHIBITING MATERIALS, USED AT THE RATE OF 1,500 POUNDS PER ACRE (OR AS RECOMMENDED BY THE PRODUCT MANUFACTURER) AND MAY BE APPLIED BY A HYDROSEEDER. THIS MULCH SHALL NOT BE MIXED IN THE TANK WITH SEED. USE IS **LIMITED** TO FLATTER SLOPES AND DURING OPTIMUM SEEDING PERIODS IN SPRING AND FALL.
   - C. **PELLETIZED MULCH.** COMPRESSED AND EXTRUDED PAPER AND/OR WOOD FIBER PRODUCT, WHICH MAY CONTAIN CO-POLYMERS, TACKIFIERS, FERTILIZERS AND COLORING AGENTS. THE DRY PELLETS, WHEN APPLIED TO A SEEDED AREA AND WATERED, FORM A MULCH MAT. PELLETIZED MULCH SHALL BE APPLIED IN ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATIONS. MULCH MAY BE APPLIED BY HAND OR MECHANICAL SPREADER AT THE RATE OF 60-75 POUNDS PER 1,000 SQUARE FEET AND ACTIVATED WITH 0.2 TO 0.4 INCHES OF WATER. THIS MATERIAL HAS BEEN FOUND TO BE BENEFICIAL FOR USE ON SMALL LAWN OR RENOVATION AREAS, SEEDED AREAS WHERE WEED-SEED FREE MULCH IS DESIRED OR ON SITES WHERE STRAW MULCH AND TACKIFIER AGENT ARE NOT PRACTICAL OR DESIRABLE. APPLYING THE FULL 0.2 TO 0.4 INCHES OF WATER AFTER SPREADING PELLETIZED MULCH ON THE SEED BED IS EXTREMELY IMPORTANT FOR SUFFICIENT AND EXPANSION OF THE MULCH TO PROVIDE SOIL COVERAGE.

STANDARD FOR PERMANENT VEGETATIVE COVER FOR SOIL STABILIZATION (CONT.)

5. IRRIGATION

   IF SOIL IS DEFICIENT, AND MULCH IS NOT USED, SUPPLY NEW SEEDINGS WITH ADEQUATE WATER (A MINIMUM OF 1/4 INCH TWICE A DAY UNTIL VEGETATION IS WELL ESTABLISHED). THIS IS ESPECIALLY TRUE WHEN SEEDINGS ARE MADE IN ABNORMALLY DRY OR HOT WEATHER OR ON DROUGHTY SITES.

6. TOPDRESSING

   NO FOLLOW-UP OF TOPDRESSING IS MANDATORY. AN EXCEPTION MAY BE WHERE GROSS NITROGEN DEFICIENCY EXISTS TO THE EXTENT THAT TURF FAILURE MAY DEVELOP. IN THAT INSTANCE, TOPDRESS WITH 10-10-10 OR EQUIVALENT AT 400 POUNDS PER 1,000 SQUARE FEET.

7. ESTABLISHING PERMANENT VEGETATIVE STABILIZATION

   THE QUALITY OF PERMANENT VEGETATION RESTS WITH THE CONTRACTOR. THE TIMING OF SEEDING, PREPARATION THE SEEDBED, APPLYING NUTRIENTS, IRRIGATION, MULCH AND OTHER MANAGEMENT ARE ESSENTIAL. THE SEED APPLICATION RATES IN TABLE 4-3 ARE REQUIRED WHEN A **REPORT OF COMPLIANCE** IS REQUESTED PRIOR TO ACTUAL ESTABLISHMENT OF PERMANENT VEGETATION. UP TO 50% REDUCTION IN APPLICATION RATES MAY BE USED WHEN PERMANENT VEGETATION IS ESTABLISHED PRIOR TO REQUESTING A **REPORT OF COMPLIANCE** FROM THE DISTRICT. THESE RATES APPLY TO ALL METHODS OF SEEDING. **ESTABLISHING PERMANENT VEGETATION MEANS 80% VEGETATIVE COVER (OF THE SEEDED SPECIES) AND MOWED ONCE.**

PERMANENT VEGETATIVE SEED MIXTURE FOR SOIL STABILIZATION FOR SOIL DISPOSAL LOCATION

REFER TO SHEET 3 OF 4 FOR PERMANENT SEED MIXTURE AND PLANTING PLAN

STANDARD FOR LAND GRADING

DEFINITION:
RESHAPING THE GROUND SURFACE BY GRADING TO PLANNED ELEVATIONS WHICH ARE DETERMINED BY TOPOGRAPHIC SURVEY AND LAYOUT.

PURPOSE:
IMPROVE SURFACE DRAINAGE AND CONTROL EROSION.

CONDITIONS WHERE PRACTICES APPLIES:
THIS PRACTICE IS APPLICABLE WHERE GRADING TO PLANNED ELEVATIONS IS PRACTICAL AND IT IS DETERMINED THAT GRADING IS NEEDED. GRADING THAT INVOLVES THE DISTURBANCE OF VEGETATION OVER LARGE AREAS SHALL BE AVOIDED. IT MAY BE NECESSARY TO PROVIDE TEMPORARY STABILIZATION OVER LARGE AREAS.

WATER QUALITY ENHANCEMENT:
PROPER GRADING OF DISTURBED SOILS WILL PROTECT AGAINST SOIL LOSS FROM EROSION, ENHANCE ESTABLISHMENT OF PERMANENT VEGETATIVE COVER AND HELP TO PROPERLY MANAGE STORMWATER RUNOFF ALL OF WHICH WILL REDUCE OFFSITE DISCHARGE OF POLLUTANTS.

PLANNING CRITERIA:
EROSION CONTROL MEASURES SHALL BE INSTALLED IN ACCORDANCE WITH THE APPLICABLE STANDARD CONTAINED HEREIN. THE CUT FACE OF EARTH EXCAVATIONS AND FILLS SHALL BE NO STEEPER THAN THE SAFE ANGLE OF REPOSE FOR THE MATERIALS ENCOUNTERED AND FLAT ENOUGH FOR MAINTENANCE AND WILL BE NO GREATER THAN THREE (3) HORIZONTAL TO ONE (1) VERTICAL IN ANY SITUATION. PERMANENTLY EXPOSED FACES OF EARTH CUTS AND FILLS SHALL BE VEGETATED OR OTHERWISE PROTECTED EROSION. PROVISIONS SHALL BE MADE TO SAFELY CONDUCT SURFACE WATER TO STORM DRAINS OR SUITABLE WATER COURSES AND PREVENT SURFACE RUNOFF FROM DAMAGING CUT FACES AND FILL SLOPES. ADJACENT PROPERTIES SHALL BE PROTECTED FROM EXCAVATION AND FILLING OPERATIONS.

STANDARD FOR DUST CONTROL

PURPOSE:
THE CONTROL OF DUST ON CONSTRUCTION SITES AND ROADS.

DEFINITION:
TO PREVENT BLOWING AND MOVEMENT OF DUST FROM EXPOSED SOIL SURFACES, REDUCED ON-SITE AND OFF-SITE DAMAGE AND HEALTH HAZARDS, AND IMPROVE TRAFFIC SAFETY.

WATER QUALITY ENHANCEMENT:
SEDIMENTS DEPOSITED AS "DUST" ARE OFTEN FINE COLLOIDAL MATERIAL WHICH IS EXTREMELY DIFFICULT TO REMOVE FROM WATER ONCE IT BECOMES SUSPENDED. USE OF THIS STANDARD WILL HELP TO CONTROL THE GENERATION OF DUST FROM CONSTRUCTION SITES AND SUBSEQUENT BLOWING AND DEPOSITION INTO LOCAL SURFACE WATER RESOURCES.

CONDITIONS WHERE PRACTICES APPLIES:
THIS PRACTICE IS APPLICABLE TO AREAS SUBJECT TO DUST BLOWING AND MOVEMENT WHERE ON-SITE AND OFF-SITE DAMAGE IS LIKELY WITHOUT TREATMENT. CONSULT WITH LOCAL MUNICIPAL ORDINANCES ON ANY RESTRICTIONS.

THE FOLLOWING METHODS SHOULD BE CONSIDERED FOR CONTROLLING DUST:

SPRAY-ON ADHESIVES: ON MINERAL SOILS (NOT EFFECTIVE ON MUCK SOILS). KEEP TRAFFIC OFF THESE AREAS.

PLANNING CRITERIA:

MATERIAL	WATER DILUTION	TYPE OF NOZZLE	APPLY GALLONS/ACRE
ANIONIC ASPHALT EMULSION	7:1	COARSE SPRAY	1200
LATEX EMULSION	12.5:1	FINE SPRAY	235
RESIN IN WATER	4:1	FINE SPRAY	300
POLYACRYLAMIDE (PAM) - SPRAY ON			
POLYACRYLAMIDE (PAM) - DRY SPREAD			
ACIDEULATED SOY BEAN SOAP STICK	NONE	COARSE SPRAY	1200

APPLY ACCORDING TO MANUFACTURER'S INSTRUCTIONS. MAY ALSO BE USED AS AN ADDITIVE TO SEDIMENT BASINS TO FLOCCULATE AND PRECIPITATE SUSPENDED COLLOIDS.

TILLAGE: TO ROUGHEN SURFACE AND BRING CLODS TO THE SURFACE. THIS IS A TEMPORARY EMERGENCY MEASURE WHICH SHOULD BE USED BEFORE SOIL BLOWING STARTS. BEGIN PLOWING ON WINDWARD SIDE OF SITE. CHISEL-TYPE PLOWS SPACED ABOUT 12 INCHES APART, AND SPRING TOOTHED HARROWS ARE EXAMPLES OF EQUIPMENT WHICH MAY PRODUCE THE DESIRED EFFECT.

SPRINKLING: BROADCAST APPLICATION OF WATER UNTIL THE SURFACE IS WET.

BARRIERS: SOLID BOARD FENCES, SNOW FENCES, BURLAP FENCES, CRATE WALLS, BALES OF HAY, AND SIMILAR MATERIAL CAN BE USED TO CONTROL AIR CURRENTS AND SOIL BLOWING.

CALCIUM CHLORIDE: SHALL BE IN THE FORM OF LOOSE, DRY GRANULES OR FLAKES FINE ENOUGH TO FEED THROUGH COMMONLY USED SPREADERS AT A RATE THAT WILL KEEP SURFACE MOIST BUT NOT CAUSE POLLUTION OR PLANT DAMAGE. IF USED ON STEEPER SLOPES, THEN USE OTHER PRACTICES TO PREVENT WASHING INTO STREAMS, OR ACCUMULATION AROUND PLANTS. NOT TO BE USED IN RETROFIT AREA, APPLICABLE ONLY TO UPLAND AREAS

STONE: COVER SURFACE WITH CRUSHED STONE OR COARSE GRAVEL.

TABLE 4-1

LIMESTONE[1] APPLICATION RATE BY SOIL TEXTURE	
SOIL TEXTURE	TONS / ACRE
CLAY, CLAY LOAM, AND HIGH ORGANIC SOIL	3
SANDY LOAM, LOAM, SILT LOAM	2
LOAMY SAND, SAND	1

1 PULVERIZED DOLOMITIC LIMESTONE IS PREFERRED FOR MOST SOILS SOUTH OF THE NEW BRUNSWICK - TRENTON LINE.

STANDARD FOR MANAGEMENT OF HIGH ACID PRODUCING SOILS

DEFINITION

IDENTIFYING HIGH ACID PRODUCING SOIL WHICH MAY BE EXPOSED DURING EXCAVATION AND LAND GRADING ACTIVITIES AND PRACTICES FOR ITS BURIAL. HIGH ACID PRODUCING SOILS ARE SOIL WITH A PH OF 4 OR LESS OR CONTAIN IRON SULFIDE.

PURPOSE

TO PREVENT OR LIMIT EXPOSURE, EXPOSURE TIME AND SPREADING BY EQUIPMENT OR RAINFALL ON AND OFF SITE AND MINIMIZE EROSION, SEDIMENTATION AND ACID LEACHATE RELATED DAMAGES.

BY ITS EXPOSURE TO AIR, SOILS CONTAINING IRON SULFIDE, CHARACTERIZED BY PYRITE OR MARCASITE NUGGETS OR GREEN SANDS, CAUSES CHEMICAL OXIDATION TO OCCUR PRODUCING SULFURIC ACID AND RESULTS IN SOIL PH LEVELS FALLING TO PH 3 AND LOWER. MOST VEGETATION IS INCAPABLE OF GROWTH AT THIS PH LEVEL. ADJACENT LAND AND RECEIVING WATERS WILL BE NEGATIVELY IMPACTED BY THE ACID LEACHATE. CALCIUM CONTAINING MATERIALS SUCH AS SIDEWALKS, CULVERTS AND OTHER STRUCTURES AND SOME METALLIC MATERIALS ARE ALSO SUSCEPTIBLE TO DEGRADATION. AGRICULTURAL LIMESTONE MATERIALS APPLIED AT RATES OF 8 TONS PER ACRE HAVE RESULTED IN ONLY A TEMPORARY BUFFERING EFFECT AN "LIMING-ONLY" IS THEREFORE NOT CONSIDERED AN ACCEPTABLE MITIGATION PRACTICE.

WATER QUALITY ENHANCEMENT

PROTECTS ON SITE SOILS AND OFFSITE STREAMS AND LAKES FROM SULFURIC ACID LEACHATE WHICH CREATES SOIL PH CONDITIONS UNSUITABLE FOR GROWTH OF VEGETATION.

WHERE APPLICABLE

THIS PRACTICE IS APPLICABLE TO ANY HIGH ACID PRODUCING SOIL MATERIALS. SUCH MATERIALS HAVE BEEN FOUND IN THE COASTAL PLAIN AREAS OF BURLINGTON, CAMDEN, MERCER, MIDDLESEX, MONMOUTH, OCEAN AND SALEM COUNTIES.

PLANNING CRITERIA

EARLY RECOGNITION AND BURIAL, REMOVAL OR DISPOSAL OF HIGH ACID PRODUCING SOILS IS ESSENTIAL FOR LIMITING THE AMOUNT OF ACIDIC MATERIAL PRODUCED.

REVIEW A SURFACE GEOLOGY MAP FOR THE PROPOSED SITE TO INVESTIGATE THE PRESENCE OF GEOLOGIC FORMATIONS WHICH COMMONLY CONTAIN HIGH ACID PRODUCING DEPOSITS. THE GEOLOGIC FORMATIONS ARE AS FOLLOWS:

ENGLISHTOWN SAND	NAVESINK FORMATION
KIRKWOOD FORMATION	RARITAN FORMATION
MAGOTHY FORMATION	RED BANK SAND
MARSHALLTOWN FORMATION	WOODBURY CLAY
MERCHANTVILLE FORMATION	

CONTACT THE LOCAL SOIL CONSERVATION DISTRICT TO DETERMINE THE HISTORICAL PRESENCE OF HIGH ACID PRODUCING SOILS IN THE VICINITY OF THE PROPOSED SITE.

HIGH ACID PRODUCING SOILS MAY BE PRESENT IN UNDISTURBED SOILS AT VARYING DEPTHS INCLUDING NEAR THE SOIL SURFACE TO EXCAVATIONS OR DEEP DISTURBANCES. ITS PRESENCE ON A SITE MAY BE SIGNIFICANT OR LIMITED IN THE SOIL PROFILE. HIGH ACID PRODUCING SOILS ARE COMMONLY BLACK, DARK BROWN, GRAY OR GREENISH WITH SILVERY PYRITE OR MARCASITE NUGGETS OR FLAKES.

ALTERNATIVELY, SANDY SOILS OF REDDISH, YELLOWISH OR LIGHT TO MEDIUM BROWN SOIL MATERIALS ARE USUALLY FREE OF HIGH ACID PRODUCING DEPOSITS.

METHODS AND MATERIALS

1. LIMIT THE EXCAVATION AREA AND EXPOSURE TIME WHEN HIGH ACID PRODUCING SOILS ARE ENCOUNTERED.
2. TOPSOIL STRIPPED FROM THE SITE SHALL BE STORED SEPARATELY FROM TEMPORARILY STOCKPILED HIGH ACID PRODUCING SOILS.
3. STOCKPILES OF HIGH ACID PRODUCING SOIL SHOULD BE LOCATED ON LEVEL LAND TO MINIMIZE ITS MOVEMENT, ESPECIALLY WHEN THIS MATERIAL HAS HIGH CLAY CONTENT.
4. TEMPORARILY STOCKPILED HIGH ACID PRODUCING SOIL MATERIAL TO BE EXPOSED MORE THAN 30 DAYS SHOULD BE COVERED WITH PROPERLY ANCHORED, HEAVY GRADE SHEETS OF POLYETHYLENE WHERE POSSIBLE. IF NOT POSSIBLE, STOCKPILES SHALL BE COVERED WITH A MINIMUM OF 3 TO 6 INCHES OF WOOD CHIPS TO MINIMIZE EROSION OF THE STOCKPILE. SILT FENCE SHALL BE INSTALLED AT THE TOE OF SLOPE TO CONTAIN MOVEMENT OF THE STOCKPILED MATERIAL. TOPSOIL SHALL NOT BE APPLIED TO THE STOCKPILES TO PREVENT TOPSOIL CONTAMINATION WITH HIGH ACID PRODUCING SOIL.
5. HIGH ACID PRODUCING SOILS WITH A PH OF 4 OR LESS, OR CONTAINING IRON SULFIDE, (INCLUDING BORROW FROM CUTS) SHALL BE ULTIMATELY PLACED OR BURIED WITH LIMESTONE APPLIED AT THE RATE OF 6 TONS PER ACRE (OR 275 POUNDS PER 1,000 SQUARE FEET OF SURFACE AREA) AND COVERED WITH A MINIMUM OF 12 INCHES OF SETTLED SOIL WITH A PH OF 5 OR MORE EXCEPT AS FOLLOWS:
   - a. AREAS WHERE TREES OR SHRUBS ARE TO BE PLANTED SHALL BE COVERED WITH A MINIMUM OF 24 INCHES OF SOIL WITH A PH OF 5 OR MORE.
   - b. DISPOSAL AREAS SHALL NOT BE LOCATED WITHIN 24 INCHES OF ANY SURFACE OF A SLOPE OR BANK, SUCH AS BERMS, STREAM BANKS, DITCHES AND OTHERS TO PREVENT POTENTIAL LATERAL LEACHING DAMAGES.
6. EQUIPMENT USED FOR MOVEMENT OF HIGH ACID PRODUCING SOILS SHOULD BE CLEANED AT THE END OF EACH DAY TO PREVENT SPREADING OF HIGH ACID SOIL MATERIALS TO OTHERS PARTS OF THE SITE, INTO STREAMS OR STORMWATER CONVEYANCES AND TO PROTECT MACHINERY FROM ACCELERATED RUSTING.
7. NON VEGETATIVE EROSION CONTROL PRACTICES (STONE TRACKING PADS, STRATEGICALLY PLACED LIMESTONE CHECK DAM, SILT FENCE, WOOD CHIPS) SHOULD BE INSTALLED TO LIMIT THE MOVEMENT OF HIGH ACID PRODUCING SOILS FROM, AROUND OR OFF THE SITE.
8. FOLLOWING BURIAL OR REMOVAL OF HIGH ACID PRODUCING SOIL, TOPSOILING AND SEEDING OF THE SITE, (SEE TEMPORARY VEGETATIVE COVER FOR SOIL STABILIZATION, PERMANENT VEGETATIVE COVER FOR SOIL STABILIZATION, AND TOPSOILING) MONITORING SHOULD CONTINUE FOR APPROXIMATELY 6 TO 12 MONTHS TO ASSURE THERE IS ADEQUATE STABILIZATION AND THAT NO HIGH ACID SOIL PROBLEMS EMERGE. IF PROBLEMS STILL EXIST THE AFFECTED AREA MUST BE TREATED AS INDICATED ABOVE TO CORRECT THE PROBLEM.
9. MONITORING OF AREAS WHERE HIGH ACID PRODUCING SOIL HAS BEEN PLACED OR BURIED SHOULD BE PERFORMED FOR AT LEAST 2 YEARS OR LONGER IF PROBLEMS OCCUR, TO ASSURE THERE IS NO MIGRATION OF POTENTIAL ACID LEACHATE.

FREEHOLD SOIL EROSION AND SEDIMENT CONTROL NOTES:

1. THE FREEHOLD SOIL CONSERVATION DISTRICT SHALL BE NOTIFIED SEVENTY-TWO (72) HOURS IN ADVANCE OF ANY LAND DISTURBING ACTIVITY.
2. ALL WORK IS TO BE DONE IN ACCORDANCE WITH THE STATE STANDARDS FOR SOIL EROSION AND SEDIMENT CONTROL OF NEW JERSEY.
3. ALL SOIL EROSION AND SEDIMENT CONTROL PRACTICES ARE TO BE INSTALLED PRIOR TO ANY MAJOR SOIL DISTURBANCE, OR IN THEIR PROPER SEQUENCE, AND MAINTAINED UNTIL PERMANENT PROTECTION IS ESTABLISHED.
4. ANY CHANGES TO THE CERTIFIED SOIL EROSION AND SEDIMENT CONTROL PLANS WILL REQUIRE THE SUBMISSION OF REVISED SOIL EROSION AND SEDIMENT CONTROL PLANS TO THE DISTRICT FOR RE-CERTIFICATION. THE REVISED PLANS MUST MEET ALL CURRENT STATE SOIL EROSION AND SEDIMENT CONTROL STANDARDS.
5. IN THAT NJSA 4:24-39 ET. SEQ. REQUIRES THAT NO CERTIFICATES OF OCCUPANCY BE ISSUED BEFORE THE PROVISIONS OF THE CERTIFIED PLAN FOR EROSION CONTROL HAVE BEEN COMPLIED WITH FOR PERMANENT MEASURES. ALL SITE WORK AND ALL WORK AROUND INDIVIDUAL LOTS IN SUBDIVISIONS, WILL HAVE TO BE COMPLETED PRIOR TO THE DISTRICT ISSUING A REPORT OF COMPLIANCE FOR THE ISSUANCE OF A CERTIFICATE OF OCCUPANCY BY THE MUNICIPALITY.
6. ANY DISTURBED AREAS THAT WILL BE LEFT EXPOSED MORE THAN THIRTY (30) DAYS, AND NOT SUBJECT TO CONSTRUCTION TRAFFIC, WILL IMMEDIATELY RECEIVE A TEMPORARY SEEDING. IF THE SEASON PREVENTS THE ESTABLISHMENT OF TEMPORARY COVER, THE DISTURBED AREAS WILL BE MULCHED WITH STRAW, OR EQUIVALENT MATERIAL, AT A RATE OF 2 TO 2 $\frac{1}{2}$ TONS PER ACRE, ACCORDING TO STATE STANDARD FOR STABILIZATION WITH MULCH ONLY.
7. IMMEDIATELY FOLLOWING INITIAL DISTURBANCE OR ROUGH GRADING, ALL CRITICAL AREAS SUBJECT TO EROSION (I.E. STEEP SLOPES AND ROADWAY EMBANKMENTS) WILL RECEIVE TEMPORARY SEEDING IN COMBINATION WITH STRAW MULCH OR A SUITABLE EQUIVALENT, AT A RATE OF 1 1/2 TO 2 TONS PER ACRE, ACCORDING TO STATE STANDARDS.
8. A SUB-BASE COURSE WILL BE APPLIED IMMEDIATELY FOLLOWING ROUGH GRADING AND INSTALLATION OF IMPROVEMENTS TO STABILIZE STREETS, ROADS, DRIVEWAYS, AND PARKING AREAS. IN AREAS WHERE NO UTILITIES ARE PRESENT, THE SUB-BASE SHALL BE INSTALLED WITHIN FIFTEEN (15) DAYS OF THE PRELIMINARY GRADING.
9. ANY STEEP SLOPES RECEIVING PIPELINE INSTALLATION WILL BE BACKFILLED AND STABILIZED DAILY, AS THE INSTALLATION CONTINUES (I.E. SLOPES GREATER THAN 3:1).
10. THE STANDARD FOR STABILIZED CONSTRUCTION ACCESS REQUIRES THE INSTALLATION OF A PAD OF CLEAN CRUSHED STONE AT POINTS WHERE TRAFFIC WILL BE ACCESSING THE CONSTRUCTION SITE. AFTER INTERIOR ROADWAYS ARE PAVED, INDIVIDUAL LOTS REQUIRE A STABILIZED CONSTRUCTION ENTRANCE CONSISTING OF ONE INCH TO TWO INCH (1"-2") STONE FOR A MINIMUM LENGTH OF TEN FEET (10') EQUAL TO THE LOT ENTRANCE WIDTH. ALL OTHER ACCESS POINTS SHALL BE BLOCKED OFF.
11. ALL SOIL WASHED, DROPPED, SPILLED, OR TRACKED OUTSIDE THE LIMIT OF DISTURBANCE OR ONTO PUBLIC RIGHT-OF-WAYS WILL BE REMOVED IMMEDIATELY.
12. PERMANENT VEGETATION IS TO BE SEEDED OR SODDED ON ALL EXPOSED AREAS WITHIN TEN (10) DAYS AFTER FINAL GRADING.
13. AT THE TIME THAT SITE PREPARATION FOR PERMANENT VEGETATIVE STABILIZATION IS GOING TO BE ACCOMPLISHED, ANY SOIL THAT WILL NOT PROVIDE A SUITABLE ENVIRONMENT TO SUPPORT ADEQUATE VEGETATIVE GROUND COVER SHALL BE REMOVED OR TREATED IN SUCH A WAY THAT IT WILL PERMANENTLY ADJUST THE SOIL CONDITIONS AND RENDER IT SUITABLE FOR VEGETATIVE GROUND COVER. IF THE REMOVAL OR TREATMENT OF THE SOIL WILL NOT PROVIDE SUITABLE CONDITIONS, NON-VEGETATIVE MEANS OF PERMANENT GROUND STABILIZATION WILL HAVE TO BE EMPLOYED.
14. IN ACCORDANCE WITH THE STANDARD FOR MANAGEMENT OF HIGH ACID PRODUCING SOILS, ANY SOIL HAVING A PH OF 4 OR LESS OR CONTAINING IRON SULFIDES SHALL BE COVERED WITH A MINIMUM OF TWELVE (12) INCHES OF SOIL HAVING A PH OF 5 OR MORE PRIOR TO SEEDBED PREPARATION. AREAS WHERE TREES OR SHRUBS ARE TO BE PLANTED SHALL BE COVERED WITH A MINIMUM OF TWENTY- FOUR (24) INCHES OF SOIL HAVING A PH OF 5 OR MORE.
15. CONDUIT OUTLET PROTECTION MUST BE INSTALLED AT ALL REQUIRED OUTFALLS PRIOR TO THE DRAINAGE SYSTEM BECOMING OPERATIONAL.
16. UNFILTERED DEWATERING IS NOT PERMITTED. NECESSARY PRECAUTIONS MUST BE TAKEN DURING ALL DEWATERING OPERATIONS TO MINIMIZE SEDIMENT TRANSFER. ANY DEWATERING METHODS USED MUST BE IN ACCORDANCE WITH THE STANDARD FOR DEWATERING.
17. SHOULD THE CONTROL OF DUST AT THE SITE BE NECESSARY, THE SITE WILL BE SPRINKLED UNTIL THE SURFACE IS WET, TEMPORARY VEGETATIVE COVER SHALL BE ESTABLISHED OR MULCH SHALL BE APPLIED AS REQUIRED BY THE STANDARD FOR DUST CONTROL.
18. STOCKPILE AND STAGING LOCATIONS ESTABLISHED IN THE FIELD SHALL BE PLACED WITHIN THE LIMIT OF DISTURBANCE ACCORDING TO THE CERTIFIED PLAN. STAGING AND STOCKPILES NOT LOCATED WITHIN THE LIMIT OF DISTURBANCE WILL REQUIRE CERTIFICATION OF A REVISED SOIL EROSION AND SEDIMENT CONTROL PLAN. CERTIFICATION OF A NEW SOIL EROSION AND SEDIMENT CONTROL PLAN MAY BE REQUIRED FOR THESE ACTIVITIES IF AN AREA GREATER THAN 5,000 SQUARE FEET IS DISTURBED.
19. ALL SOIL STOCKPILES ARE TO BE TEMPORARILY STABILIZED IN ACCORDANCE WITH SOIL EROSION AND SEDIMENT CONTROL NOTE #6.
20. THE PROPERTY OWNER SHALL BE RESPONSIBLE FOR ANY EROSION OR SEDIMENTATION THAT MAY OCCUR BELOW STORMWATER OUTFALLS OR OFFSITE AS A RESULT OF CONSTRUCTION OF THE PROJECT.

CALL BEFORE YOU DIG!
NEW JERSEY LAW REQUIRES 3 WORKING DAYS NOTICE FOR CONSTRUCTION PHASE AND 10 WORKING DAYS IN DESIGN STAGE – STOP CALL
NEW JERSEY ONE CALL SYSTEM, INC.
REFERENCE NEW JERSEY TITLE 48, CHPT. 2, ARTICLE 9
1-800-272-1000

PROJECT NOTES

GENERAL NOTES:

1. 72 HOURS PRIOR TO ANY SOIL DISTURBANCE, NOTICE IN WRITING, SHALL BE GIVEN TO THE FREEHOLD SOIL CONSERVATION DISTRICT

DATE	DESCRIPTION

REVISIONS

STATE OF NEW JERSEY CERTIFICATE OF AUTH. NO.: 24GA27976800

KEITHE J. MERL
Professional Engineer
NJ Lic. No. GE44839

DATE

PRINCETON HYDRO, LLC
SCIENTISTS AND ENGINEERS
120 EAST UWCHLAN AVENUE
SUITE 204
EXTON, PENNSYLVANIA 19341
PHONE. 610.524.4220
FAX. 610.524.9434
WWW.PRINCETONHYDRO.COM

PROJECT NAME/LOCATION:
DRY DETENTION BASIN RETROFIT
AT STATION #84
MANALAPAN TOWNSHIP
MONMOUTH COUNTY, NEW JERSEY

DRAWING NAME:
EROSION AND SEDIMENT CONTROL NOTES

DATE:	02/28/2011
PROJECT NO.:	0457.008
SCALE:	NOT TO SCALE
DRAWN BY:	JEO
CHECKED BY:	KJM

SHEET NO. 4 OF 4