

12.0 RESERVATION AREAS

The distinct areas within South Mountain Reservation have been identified and boundaries associated with them (Map 3.16). The following section describes the observed uses, facilities, buildings and structures for each area. See Map 3.15 Historic Vistas for the location and names of these 29 vistas.

12.1 Locust Grove



Figure 35 – Locust Grove Picnic Area

General Overview

Locust Grove is located at the southern terminus of South Mountain Reservation. The area consists of a parking area and a picnic area. This area is often one of the most used areas. It serves as a trailhead for several trails including the River Trail, Rahway Trail, Lenape Trail and Old Quarry Trail. It has a paved parking area and is located close to downtown Millburn, across Glen Avenue from the Millburn train station. There has almost always been vehicles present at all times of the day and is nearly full from mid-morning to dusk. The parking lot is overflowing on most weekends. The picnic area, although not as heavily used as other areas of the Reservation, is in close proximity to the parking lot. The primary use however, appears to serve as a starting point for hikers as there are often many cars but few people in the area. There are no restroom facilities provided at this location.

Parking and Circulation

The parking lot is located at the southern terminus of the Reservation. This parking lot serves as the parking for the Locust Grove picnic area and as the southern trailhead for the Maple Falls trail. It has one means of ingress and egress from Glen Avenue. It has a single loaded bay of parking on the eastern side of the driveway, which can accommodate approximately 18 cars based on a length of 160 feet. There



Figure 36 – Locust Grove Parking Lot

was one car which parallel parked on the western side of the drive, opposite the bay of parking. Parking spaces are not delineated by striping and there are no ADA accessible spaces. A large piece of concrete blocks vehicular access to the picnic area (although a Jeep was observed driving around the block to access the picnic area).

The main area consists of one covered shelter, 16 picnic tables and 8 barbeque grills. The secondary area contains two picnic tables and a grill.

Structures

The covered shelter in this area is approximately 29 feet long and 20 feet wide. It consists of eight (8) 5" square metal posts that support the wooden roof supports. The shelter covers an exposed earth floor that is edged with an approximately 2 ft wide stone band. There is damage to the roof on the northern side where it looks like a large branch struck the edge. There are large rocks and logs located within the shelter area.



Figure 37 – Locust Grove Picnic Shelter

Furnishings

There are 3 trash receptacles (55 gallon metal drums) located in this area. There are two types of picnic tables in this area. One type is twelve (12) feet long and is comprised of mortared stone supports on a concrete base with 2" thick wood benches and top. The second type is eight (8) feet and is comprised of tubular metal supports with wood benches and top. Several of the stone supports for the 12-foot tables have been repaired or replaced with brick. There is also damage to several tabletops. There is a pipe protruding from a rock in the northwest corner of the main area that appears to be used for collecting spring water by the public. There is a water fountain (not yet turned on) on the southern edge of the primary area. However, the fountain is within the edge of brush and almost appears to be discarded. There were no trash receptacles in either area (possibly due to the fact that the concrete block may make collecting trash difficult for getting a truck to this area). The grills have all become rusted.

Lighting and Signage

A trail map is located at the northern end of the parking lot. There is no lighting in this parking area.

12.2 Maple Falls

Maple Falls is located in the southern section of the Reservation. Maple Brook, starting up the mountain in the wetlands in the Deer Paddock, flows over a small bedrock escarpment. The Lenape Trail crosses Maple Brook near the top of the falls. There is no trail access to the base of the falls. The River Trail and Rahway Trail crosses Maple Brook close to the falls. Vegetation has overgrown the views of the base of the falls. Erosion is occurring on the sides of the two bridges that cross Maple Brook. Studies should be conducted to see if the bridges' span should be enlarged.



Figure 38 – Top of Maple Falls showing overgrown vegetation at the base.



Figure 39 – Base of Maple Falls showing overgrown vegetation.

12.3 Washington Rock Overlook

General overview

Washington Rock overlook is located at the southern terminus of Crest Drive.

Parking

The parking lot is located on the inside of the terminus of Crest Drive. It consists of a single access drive with parking on both sides. The parking area is approximately 280 feet long accommodating about 60 vehicles. There is no striping or ADA accessible parking. The strip between the parking lot and Crest Drive is asphalt with openings for trees at 38 feet on center. There was only one small conifer tree alive in one of the plantings. There was a small dead conifer in another opening while the rest of the openings were empty. The parking lot is edged with Belgian block curbing. No vehicles were parked here, as the area is not open to vehicular traffic.



Figure 40 – Washington Rock Overlook

Circulation

Pedestrian circulation is via asphalt walkways that lead from Crest Drive down to the outlook. There are two walkways; with one including a set of asphalt steps that has one inch to two inch rises. The area is not currently accessible by vehicle for the public, although Crest Drive is paved and provides a means of access for maintenance and emergency vehicles.

Structures

The main structure in this area is the overlook itself, which is a concrete platform with stone post and metal railings. Along crest drive is a mortared stone wall that serves as protection from the steep drop-off along that part of Crest Drive.

Furnishings

Six benches (concrete seats, five with wood backs, one with no back) There is only one trash receptacle

Lighting and Signage

The only signage in this area is a small plaque on a large boulder near Crest Drive. There is no other signage in this area and there is no lighting.

12.4 New Jersey American Water Company Structure



Figure 41 – Low side of NJ American Water Holding Tank and access towers.

Just southeast of the Washington Rock overlook is a large concrete structure owned by New Jersey American Water Company. This structure is two concrete water storage tanks and is used to supply water to adjoining neighborhoods in Millburn and Maplewood. It covers an area approximately 15,000 square feet and is approximately 200 feet long by 100 feet wide. The structure is enclosed by a 10-foot high chain link fence and is restricted from the public. There are structures and pipes on the downhill side of structure that carry water to and from the storage tanks. The top is flat and covered with a manicured lawn.

12.5 Crest Drive Overlook

About halfway between the terminus of Crest Drive (Washington Rock) and the Summit Field Picnic area is an unnamed overlook on the east side of Crest Drive. Vegetation blocks most of the view to the east. The area was used as a parking lot although it is currently not accessible by vehicle due to gates across Crest Drive at Summit Field.



Figure 42 ~ Crest Drive Overlook

The surface is comprised of stone aggregate, filling in with weeds and turf. The area is approximately 160 feet long by 60 feet wide that could accommodate 16-18 cars, single loaded or 32 to 36 if two bays are provided. The east edge of the area drops off drastically in topography. Protection is provided in the form of wood pilings approximately 4-5 feet on center and extended 2 to 3 feet above grade. These are located approximately five to six feet from the edge. There are also about 10 concrete wheel stops in front of the wood pilings, for the southern two-thirds of the area. There are no lights in this area and one trash receptacle is provided at the edge of Crest Drive at the midpoint of the parking area. There is no signage in this area.

12.6 Bramhall Terrace



Figure 43 – Bramhall Terrace.

Bramhall Terrace is a scenic overlook area located along Crest Drive between the entrance and exit of Bear Lane. The overlook provides a clear view east towards New York City. The area consists of the outlook itself, a small memorial area between the outlook and Crest Drive, and a parking lot. The area appears to be one of the more recently renovated areas. The area has a northern half and a southern half, with both sides being almost identical.

Parking and Circulation

Primary access to this area is via Crest Drive that separates the parking area from the overlook itself. Parking for this area is comprised of two bays accessed directly from Crest Drive. Each bay can accommodate approximately forty vehicles for a capacity of eighty vehicles total.

There are several pedestrian connections in this area. An asphalt paved path parallels Crest Drive and runs from South Orange Avenue and terminates at the entrance to Bear Lane (by the stairway). A wood trail runs from Crest Drive between the two parking bays runs west towards the Summit Field picnic areas. A U-shaped asphalt path runs from Crest Drive, along the overlook, and connects back to Crest Drive. Sets of bluestone stairs are located at the center of the overlook opposite the entrance to the wood trail.

Structures

The two structures in this area are the bluestone stairs and a mortared stone wall along the overlook. The stairs area separated into two sections by a central stone monument with plaque. The stairs are constructed of slabs of bluestone and consists of four risers and approximately 5-6 feet wide each. There are no handrails for the stairs. The stone wall is approximately three feet high and runs the length of the viewing area.

Furnishings

The primary furnishings in this area include trash receptacles and benches. Several benches are located adjacent to the walking path along Crest Drive. These are five feet in length and constructed of wood slats painted green that form the seat and back and are supported by metal tube frame. The viewing area contains eight benches of the same type, four north of the stairs and four south of the stairs. The wood on some benches is

damaged and need replacing. There are approximately six trash receptacles, three adjacent to each parking area.

Signage and Lighting

The only signage in this area consists of general park regulations. There is lighting in this area.

12.7 Bear Lane Stairs

The stairway connects an asphalt path that connects the residential area to the east starting at Claremont Avenue and leads up to Crest Drive. At the top of the stairs, there is a small pedestrian area adjacent to Crest Drive. There is a stone sitting wall that borders this area. One trash receptacle is in the north end of this area. The stairs are in poor condition and need to be reconstructed.

Stairs

The stairs are constructed of bluestone slabs as treads (2 side-by-side per tread), dry laid on a base of stone or broken concrete. The treads appear to have been mortared together but the mortar is cracked and separated from the treads in many places due to settling of the treads. There are 12 sets of treads with 11 risers (bottom tread is flush with path). There are no handrails either side of stairs. The treads are wobbly and uneven due to not being on a solid base and presents a safety hazard.

Path

The asphalt path is approximately 6 feet wide and is edged with Belgian block. There is a cobble gutter along a portion of the path. The walkway and gutter are passable. Portions of the walkway are failing and the gutter needs to be reset to direct the water to the culvert. Maintenance of the gutter keeping it free of debris is required.

12.8 Summit Field Picnic Area



Figure 44 – Summit Field Picnic Area

The Summit Field Picnic area is located to the west of Crest Drive near Bramhall Terrace and the Deer Paddock. Parking is located along Bear Lane that forms a u-shaped loop around Summit Field. Summit Field is comprised of three separate picnic areas. The picnic areas have distinct names, North [Grove A], East [Grove B] and South [Grove C]. There is no signage on Bear Lane or near the picnic areas identifying place names or giving direction to different areas.

Summit Field and associated East Ridge Drive (Crest Drive) is the most used area of the Reservation. East Ridge Drive (Crest Drive) beyond Bear Lane is a very heavily use route for walkers, joggers, and bikers. The paved surface provides one of the few places where bicycles are legal. It also provides a safe area for parents with strollers. Washington Rock Overlook is at the terminus of Crest Drive.

Summit Field contains one the largest picnic areas in the Reservation with three separate picnic areas with easy access from parking areas along the Summit Field loop roadway. There is a restroom facility for this area. The façade is of the same design as the historic restroom built by the CCC. The adjacent deer paddock is the site of a proposed dog park, which will increase users in this area.

Bramhall Terrace is adjacent to Summit Field to the east. This overlook is highly used for its views of New York City beginning at the Reservation's conception through today. Many people were also seen sitting in their parked cars in the parking lots that along Crest Drive.

The area also is a trail head to the trail network in the southeastern section of the Reservation. Numerous parking areas are provided along Crest Drive and the Summit Field Loop.

Parking and Circulation

The area is accessible by both vehicular and pedestrian circulation. Bear Lane is a one way (clockwise) paved road that starts on Crest Drive near the Deer Paddock, wraps around

Summit Field and exits back onto Crest Drive between Bramhall Terrace and South Orange Avenue. There are two parking areas along the road. The first area is near the Deer Paddock and consists of two bays of parking, one on each side of the roadway backing into the roadway. The southern bay is approximately 435 feet long accommodating approximately 45 to 48 vehicles. The northern bay is shorter at approximately 345 feet long accommodating 35 to 38 vehicles. The spaces are not delineated by striping and there are no marked ADA accessible spaces. The parking area is edged by Belgian block curbing. The area has no lighting and there are 5 trash receptacles.

The second parking area is located near Grove A on the western side of Bear Lane. It consists of a single bay of parking approximately 220 feet long accommodating approximately 24 vehicles. The spaces are not delineated and there are no marked ADA accessible spaces.

There are two walkways that connect Grove A area to the parking lot on Bear Lane. One is a sloped asphalt path while the second is a stairway composed of asphalt treads and granite block nosings. The steps are uneven and on many treads, the granite block sticks up above the asphalt and is angled causing a tripping hazard.

Structures

Each picnic area contains one shade shelter. The shade shelters are the original historic shelters. They are approximately 21 feet wide and 31 feet long. They are constructed of 12" diameter timber posts 9'-6" on center supporting a corrugated metal over wood roof. The posts are set in a stone masonry foundation that forms a two-foot wide rectangle around the base of the structure. The shelter in Grove A is enclosed by two rows of timber rails with openings in the long sides of the structure. The top rail forms the back to a bench seat that runs around the inside of the structure. The bench seat is warped and in disrepair in some spots. In Groves B and C, the structures are enclosed by three rows of 4x6" timber rails with entrance openings in the long sides of the structures. The shelters in Groves B and C do not include a bench. Inside the shelters, there are no floors other



Figure 45 – Summit Field Picnic Shelter

than exposed dirt. All shelters exhibit some deterioration to the base of the vertical posts also to the rails. Some rails are out of place or missing in the Grove B shelter. There is damage to the end of one of the rafters as well as graffiti on some of the posts in Grove A.

Along the wood road that connects Bramhall Terrace to the picnic areas between Groves A and B, there is restroom facility. The building is approximately 16 feet by 28 feet. The building is constructed out of field stone. The exterior of the building was covered in graffiti. The

building appeared to be in good condition, although it was closed at time of the site visit so it is unknown if the building is operational.

Furnishings

Each picnic area contains eight picnic tables, four barbeque grills, and two drinking fountains. The picnic tables are 12' long stone base tables. Some tables in all areas have damaged or deteriorated tops and seats. There is also deterioration to the stone bases on some tables. All the grills are rusted and deteriorated. One grill in Grove B is broken off its base. The drinking fountains are in good condition.

12.9 Brookside Drive

Several unnamed parking areas have developed along Brookside Drive, particularly between Dogwood Hillside and the maintenance area and by Campbell's Pond. Hikers and fisherman are looking for close access to the River. A couple areas are quite large while most are basically small pull-offs that accommodate 2 or 3 cars only.



Figure 46 – One of the parking areas along Brookside Drive

12.10 Campbell's Pond

Campbell's Pond is located adjacent to Brookside Drive across from Hawk Hill. Access to the Pond is from the east on either the Rahway Trail or the River Trail which run parallel in this area. Campbell's Pond Dam is located at the southern end of the Pond. There used to be a pedestrian bridge across the dam. It is currently closed to the public cutting off a much



Figure 47 – Campbell's Pond

needed east/west access across the River. The dam is in need of repair as leaking through the face was observed. The pond is used by fishermen who park on the east side of Brookside Drive next to the Pond. There is a footpath along the entire eastern shore either from fishermen or deer, or both. NJ Fish and Wildlife stock the Pond. The City of Orange's historic pumping station building is located on the eastern shore close to the dam. A modern pump building owned by the City of Orange exists to the south of the dam. An abandoned well is located on the west side of Brookside Drive across from the dam. See the Buildings and structures section of Chapter 4 for more discussion of the dam and pumping station. Thistle Mill Ford is located just north of Campbell's Pond.

12.11 Thistle Mill Ford

Thistle Mill Ford is located between Campbell's Pond and Painter's Point along the West Branch of the Rahway River. This is a flood plain with sand deposits on the shorelines and basalt outcroppings on the west bank. The River once flowed only on the east side of the basalt. Now, however, the River has created a delta around a knob of basalt and reconnects at the mouth of Campbell's Pond. A timber footbridge similar to the other historic bridges in the Reservation was historically located in this area to provide one of the few crossings over the River. The bridge was removed by the Park Commission due to disrepair and unlike other bridges, this bridge was never rebuilt. Bluestone steps still exist leading from Brookside Drive down to the River. The Olmsted Plan No. 68 shows plans for a shelter to be located in this area. Thistle Mill Ford can be reached from the Rahway and River Trails. A footpath exists from Painters Point along the west side of the River, but ends apparently from loss of the shoreline due to the natural movement of the River.

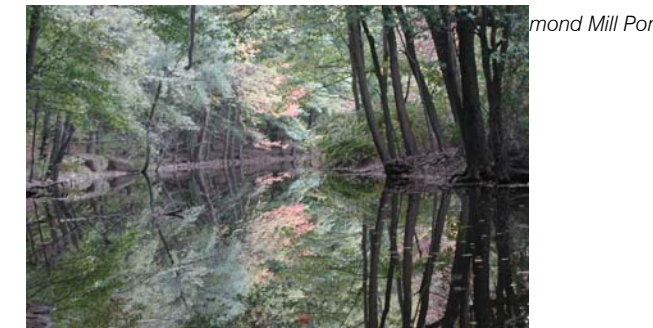


Figure 48 – Thistle Mill Ford

12.12 Diamond Mill Pond

Diamond Mill Pond is in the southern tip of the Reservation. The pond is heavily used by fishermen who park on the east side of Brookside Drive next to the Pond. NJ Fish and Wildlife stock the pond. There is a footpath along the entire eastern shore either from fishermen or deer, or both. There is no access across the top of the dam. There is, however, access to the dam from the east along a spur trail from the Maple Falls Trail. The Rahway River Trail crosses the spur road. The Maple Falls Trail and the Rahway River Trail provide duplicate access to Diamond Mill Pond. There is a long row of parking directly off of Brookside Drive that stretches from Glen Avenue to the Diamond Mill Pond Dam. It is a single loaded bay that ranges from a single car length deep near Glen Avenue to approximately 30 feet deep near the dam. Only one trash receptacle is located in this area and as result large amounts of trash found in the vegetation.



Figure 49 – Diamond Mill Pond Dam



Figure 50 – Diamond Mill Pond Dam

12.13 Elmdale

The Elmdale area is located on the west side of Brookside Drive between Diamond Hill Pond and Campbell's Pond. It consists of an unpaved parking area, picnic area and serves as a trailhead for the Elmdale trail. This area is rarely used. There are no accessible trails from this area as the Elmdale Trail is choked with vegetation and is impassable without going off trail for a major distance. The picnic area is very small and only provides a couple of tables. There is no open field associated with this picnic area. There are no restroom facilities provided at this location.

Parking and Circulation

The parking area is approximately 300 feet long allowing for parking of about 30 cars. The area is unpaved and there is no defined edge to the parking area. At the north end of the picnic area is the trailhead for the Elmdale Trail. The trail is not marked and easy to miss as there are no trail markers or trail maps present. This area appears to include an area of wetlands near the trailhead.

Structures

The only structure in this area is a small crossing that connects the parking area to the picnic area that is separated by a drainage ditch. The crossing covers a 36" concrete pipe and has a mortared stone or stone veneer flared headwalls at either end of the pipe. The headwalls are in good condition and the pipe appears to flow freely as there is not build-up of sediment.

Furnishings

The picnic area consists of two 12-foot stone picnic tables, both of which are in good condition. There are three barbeque grills, one pedestal mounted, one campfire pit and a pedestal with no grill. There are two trash receptacles located adjacent to the parking area, both full of refuse and one trash receptacle (full) located in the picnic area.

Signage and Lighting

Signage including place name and area regulations are present adjacent to the bridge on the parking lot side. The parking area has no lighting other than spillage from the roadway lighting on Brookside Drive. There is no lighting for the picnic area.



Figure 51 – Parking and drainage with culvert and headwall at Elmdale Picnic Area.

12.14 Hawk Hill / Bow Point

Hawk Hill / Bowpoint is located on the west side of Brookside Drive across from the southern end of Campbell's Pond. The area consists of a dirt parking lot and a large, hilly open lawn. The area serves as a trailhead for the Elmdale trail.

This area is not heavily used. Only a couple cars have been counted in the parking area at various times of the day, most of them with people sitting in them. The area provides access to some of the lesser-used trails, Elmdale Trail and the West Ridge Trail.

Parking and Circulation

Parking for this area is accessed directly from Brookside Drive. The parking lot is a large dirt area and has no structured limits. Based on the size the area could accommodate approximately 20 vehicles.

Hawk Hill provides access to several walking trails. A mapped trail leads northwest along a ravine and intersects with the Elmdale trail that begins at the Elmdale Picnic Area. As the trail continues it becomes less and less defined. It eventually wraps around and connects to a very well maintained and defined trail. It appears as if the intent is for the first trail to be abandoned. However the trailhead for the maintained trail is simply an opening in the vegetation along the edge of the open lawn. No signage or pathway directs visitors to this trail. Another trailhead is located north of the unmarked trail, but is at least marked with a trailhead marker (Elmdale).



Figure 52 –View from the limits of the meadow showing the First Mountain in the distance. Parking is in the middle right of the picture.

Structures

To the west, where the trails intersect, is a small stone masonry headwall for a box culvert taking drainage under a trail.

Adjacent to the parking area is small structure that houses an active water well. According to NJDEP GIS data, this is well #5 owned by the Orange Water Department. The building has a natural stone veneer. Graffiti is present on the door and back side of the building. Across From this building on the eastern side of Brookside Drive, is a similar structure. However, the well (formally identified as well #1) is no longer active. The building is partially closed off by a chain link fence with barbed wire.

Furnishings

The only furnishings present are two trash receptacles located in the parking area.

Lighting and Signage

The only signage in this area two trail markers, one located at the crossing where the trail from the parking lot intersects the trail from the Elmdale picnic area. The second is at the trailhead located at the edge of the field. There is no trail map located at the parking area to that could give visitors direction to the trails. There is no general signage identifying the area. The only lighting would be spillage from the roadway lighting on Brookside Drive.

12.15 Painters Point

Painters Point consists of three small separate picnic areas along the edge of the Rahway River and a large open lawn.

This area was not heavily used but cars were observed there on a regular basis. The area provides a couple small picnic areas and access to the Rahway Trail. Dumped debris was observed at several different times at this area.

Parking and Circulation

The area is accessed via an access drive that begins at Brookside Drive where it is partially paved before transitioning to gravel and dirt for the majority of the drive and ends at the third picnic area. There is a gravel parking area adjoining the first picnic area closest to Brookside Drive. Parking along the remainder of the access drive is not defined



Figure 53 – Access road is gravel after the paved connection to Brookside Drive.

Structures

Adjacent to this area, to the north, is a building that is identified by NJDEP GIS data as well #2 owned by the Orange Water Department. The building is 10ft x 15 ft brick masonry structure. The building is surrounded by an eight-foot chain link fence topped with barbed wire.

Furnishings

Each picnic area contains one picnic table, one barbeque grill, and one trash receptacle. The picnic tables are eight foot long, with wood tops and seats that are supported by vertical metal tubes. The grills are pedestal mounted and are rusted.

Lighting and Signage

There is no signage or lighting in this area.

12.16 Lilliput Knob

Lilliput Knob is located along the same section of the Lenape Trail as Beach Brook Cascades. The topography in this area is a knob made out of basalt that is 10 feet higher than the surrounding adjacent points to the east. The knob is formed about 30 feet to the west and could provide good views, even though there was not a view historically noted at this point. The view from Mines Point in the east was to cross Lilliput Knob and Beech Brook Cascades.

12.17 Beach Brook Cascades

Beech Brook Cascades is located in the central portion of the southern half of the Reservation. The cascades occur when Beech Book flows over exposed bedrock down the First Mountain. The headwaters for Beech Book begins in the wetlands in the deer paddock and to the north

of the intersection of Bear Lane Trail and Overlook Trail. The Lenape Trail crosses the Cascades and is the only area where a trail crosses the Cascades. This section of the Lenape Trail can be accessed from the Pingry Trail in the south and the Bear Lane Trail from the north.

12.18 Dogwood Hillside/Bend Point



Figure 54 – Dogwood Hillside

This area is located to the west of Brookside Drive just north of Planters Point. The area consists of a large open lawn used passive recreation and an unpaved parking lot. The parking area is accessed by two entrances at either end of the parking area. The narrowness of the entrances would make it difficult for vehicles to enter and exit at same time. The parking area is approximately 375 feet long accommodating 40 to 45 vehicles. There is no signage in this area other than regulatory signs. There are two trash receptacles (both full) adjacent to the parking. There is no lighting for this area.

This area is a popular area for dog owners and for sledding when snow is present. The area provides no amenities for picnic use or hiking trails. There is access to the Elmdale Trail at the

far corners of the clearing but they are unmarked. Most users who were observed in this area, were utilizing the large open lawn area for letting their dogs run. Other people like to sit in their cars for passive recreation.

12.19 Shady Nook

Shady Nook is a small picnic area located east/northeast of the intersection of South Orange Avenue and Cherry Lane.

This area was not observed to be heavily used at the times of visit. The poor access and unpaved parking area limits the number of users. One or two cars at a time were observed in this area at various times during the day. Restroom facilities are provided by portable toilets.



Figure 55 – Shady Nook Picnic Area

Parking and Circulation

The area is accessed from an entrance off of Cherry Lane that is marked by a sign and a curb cut. The driveway is uneven with large depressions and is best suited for off-road capable vehicles. The limits of the parking are not defined and there is no organization to areas where people can park. There is a footbridge at that links the area to the Tulip springs area along the Lenape Trail although it is not easy to find as there is no signage near the use are and the Lenape Trail crosses the access drive.

Structures

The structures in this area include a covered shelter and two portable toilets. There is evidence of another shade shelter having once existed in the area as there is a rectangular stone foundation matching the bases found at other shelters. The shelter that exists now is approximately 20 feet long by 16 feet wide. It is supported by 5"x7" rectangular painted metal posts eight feet on center on the long side and 12 feet apart on the ends. The roof is asphalt shingles over wood sheathing and is supported by wood rafters. The shelter has a concrete floor. Overall the shelter is in good condition and the only noticeable deterioration is where the paint on the post has peeled and rust has formed.



Figure 56 – Picnic shelter remnants from original shelter.



Figure 57 – Existing picnic shelter at Shady Nook Picnic Area.

Furnishings

The furnishings in this area consist of ten picnic tables, five barbeque grills, and six trash receptacles. There are two types of picnic tables: three twelve foot historic tables, and then eight-foot metal frame tables.

Lighting and signage

There is an identification sign at the entrance on Cherry Lane. Within the area is a sign indicating the area is permit only and a sign for preventing forest fires. There is no lighting in this area.

12.20 Tulip Springs

Tulip springs is located between South Orange Avenue and Orange Reservoir. It is access via a paved road that connects to Cherry Lane just north of the Shady Nook Picnic Area and terminates at a cul-de-sac near South Orange Avenue. The area consists of two picnic areas (north and south), a large paved parking lot, a restroom building with two portable toilets next to building and a small bridge leading the Shady Nook Area.



Figure 58 – Tulip Springs Picnic Area looking north from the drive cul-de-sac.

This area was observed to be one of the more popular destinations. Many people tend to park along the access road towards the cul-de-sac and sit in their parked cars. The picnic area itself was not observed to be heavily used during times of visit. Several cars were observed in the parking lot from late morning into the afternoon. This parking area provides access to Lenape Trail that intersects and follows the River Trail and Hemlock Falls Trail to Hemlock Falls. Restroom facilities are provided by portable toilets because the restroom building is not operational.

Parking and Circulation: The parking lot is surfaced with asphalt and is not striped. No ADA accessible spaces are present. The parking lot is lit by one cobra head fixture on the west edge of the lot. The lot is approximately 125 feet by 95 feet. This could accommodate 40 to 50 cars based on how they are organized. There were only four to five cars present at the time of analysis.

Structures

The north area consists of a covered shelter, two portable toilets, drinking fountain, 14 picnic tables (six eight-foot round tube tables, three eight-foot straight metal post tables, four eight-foot plastic tables, and one 12-foot stone base table), eight barbeque grills, and four trash receptacles. The shelter is approximately 30 feet long by 20 feet wide and is supported by 5" square metal posts.



Figure 59 – Non-functioning restroom building with port-a-potties servicing area



Figure 60 – One of two picnic shelters provided

Furnishings

The south area consists of a covered shelter, drinking fountain, 14 picnic tables (six eight-foot round tube tables, three eight-foot straight metal post tables, four eight-foot plastic tables, and one 12-foot stone base table), eight barbecue grills, and four trash receptacles.

12.21 Mines Point

Mines Point is located along the Lenape Trail and can be accessed from Bear Lane Trail. Trails connecting from Summit Field are overgrown with vegetation. The historic view from this point was to the south across meadow and woods to the River below. The view today is blocked with overgrown vegetation.

12.22 Ball’s Bluff

Ball’s Bluff is located along the Lenape Trail and can be reached from Ball’s Bluff Trail and a connector trail from Overlook Trail. This location was noted historically as a good view the north of the First and Second Mountains and Orange Reservoir. Today the view is overgrown with vegetation. The meadows were more extensive in the early 20th Century. Remnants of shelter columns exist and can be seen from Ball’s Bluff Trail. A trailside seat also remains at this location.

12.23 Hemlock Falls

Hemlock Falls is located near South Orange Avenue between Crest Drive and the River. It is formed by Hemlock Brook, which begins in the Village of South Orange, flowing over a basalt escarpment. Hemlock Falls is one of the distinguishing landscape features in the Reservation and one of the reasons the land was acquired as part of the Reservation. Hemlock Falls can be accessed from River Trail along



Figure 61 – Hemlock Falls in the winter.

Hemlock Trail and from the Lenape Trail. There are two bridges in the area. See Chapter 4 Section 7.2.3 for more information on the bridges. There are steps that lead to the top of the falls. The area at the top of the falls and the foot of the falls is highly used. There is one bench in the area that does not face the falls. The escarpment continues north of the falls where there is a nice pocket of wildflowers.

12.24 Boy Scout Camp

The Boy Scout camp is a small area at the southern end of Orange Reservoir and north of the Tulip Springs picnic area. The area consists of a single cabin and an outhouse.

Parking and Circulation

The area is accessed via a sandy path that leads from a parking lot. Several cars were observed in this parking area even when the Boy Scout Camp was not active. This parking is acting as a trailhead for access across the West Branch of the Rahway River. The River is fordable at low flow by using the stones in the river as stepping-stones across.

The parking lot is a single loaded bay approximately feet long and is accessed off of Cherry Lane.



Figure 62 – Boy Scout Camp and trailhead parking area



Figure 63 – Boy Scout Camp sSingle cabin



Figure 64 – Boy Scout Camp outhouse.

Structures

The structure appears to be in good condition and was locked at time of site visit. The outhouse was defaced with graffiti.

12.25 Oakdale Picnic Area

Oakdale is a large area near the intersection of Cherry Lane and Northfield Avenue. It consists of a large paved parking lot, restrooms, picnic area, an abandoned structure that appears to have one day served as a concession building, and large open lawns.

The Oakdale picnic area and surrounding open areas were observed as one of the most popular areas. The parking often contains around 20 cars from late morning into the

afternoon. People utilize the picnic areas and walk along Valley View Drive that provides a paved walking surface. The open fields are used for archery, exercising and playing with dogs and for sledding in the winter. The Oakdale Trail can be accessed from a connector trail. The Oakdale Trail is not a loop trail, but can be made into a loop if the user knows to use the Lenape Trail and the West Ridge Trail. Restroom facilities are provided by Portable toilets because the restroom building is not operational.

Parking and Circulation

Vehicular access is via a driveway from Cherry Lane. The driveway is forked at the entrance providing ingress and egress for traffic from northbound Cherry Lane separate from the traffic exiting the parking lot. Vehicles have been observed to pull onto the grass and park adjacent to the wood rows in this area.



Figure 65 – Oakdale Picnic Area parking .

Structures

The restroom is a masonry structure approximately 16 feet x 40 feet. It is composed both men’s and women’s facilities, and a possible utility or storage area between them. There are three metal doors on the north face of the building with the left door for women’s room, center door for presumably utility/storage and right most door is for the men’s room. The roof is a. The building is currently closed and facilities are provided by means of portable toilets.

The abandoned structure is a wood structure approximately 48 feet long and 24 feet wide. The building consists of a 36 feet by 12 feet enclosed building with the remainder being a covered shelter along the front and left side. Timber posts eight feet on center support the roof along the front and left side. The front left and right corner posts are missing. There are large windows with ledges facing the covered area indicating this structure may have once been a concession stand. The wood floor of the building is approximately one foot



Figure 66 – Non-functioning restrooms. Port-a-johns are provided.



Figure 67 – Abandoned structure. Appears to have been a concession stand.



Figure 68 – Archery storage shed.

above grade and there appears to be no stairs along the perimeter of the building. The building has been neglected for some time and there are large holes in the floor of the covered

area. The windows are all boarded up except for a missing door on the front of the structure revealing debris inside the building.

To the north there is a small equipment shed adjacent to the large open field. The shed is a wooden structure approximately 8’x10’ and is a generic stock shed out of character for the park.

It is used to store archery equipment. When the equipment is in use vehicles are parked on the grass adjacent to the wood line near the shed.

Furnishings

Furnishings in this area consist of 13 picnic tables, 9 grills, 7 trash receptacles, and one drinking fountain. The main area contains five historic tables, three 8’ black metal mesh benches, and two 6’ metal tube frame tables. There are six pedestal mounted barbeque grills and there is one drinking fountain. The secondary area contains three 6’ metal tube frame tables, three grills and one trash receptacle. There are a total of six trash receptacles located adjacent to the picnic area and the parking lot.

Signage and Lighting

Signage for this area includes general park regulations, traffic control signage and an area identification sign on Cherry Lane. The parking lot contains lighting consisting of cobra head style fixtures.

12.26 Mayapple Hill

General Overview

Mayapple Hill is a large area at the northern most end of South Mountain Reservation. It consists of a large parking lot, baseball field, restrooms, two picnic areas (north area and south area), and walking trails. A long loop road encompasses the area. The area borders a future major subdivision to the northwest named Northfield Village and a large multi-family development to the west named Viscaya.

There are a total of 490 dwelling units that will be constructed over the upcoming years (110 single family homes, 296 townhouses and 84 tower flats). 225 of these dwelling units will be located on lands adjacent to the Reservation.

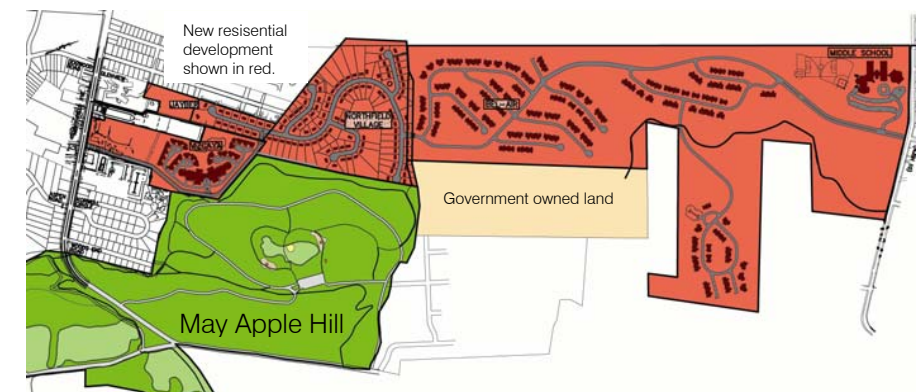


Figure 69 ~ New land uses adjacent to Mayapple Hill

Despite its size, this area was not heavily used as would be expected. There were, however, people observed walking the loop around the picnic areas. There is a functioning restroom facility, however, it is in need of several repairs.

Parking and Circulation

There are two main routes for vehicular access to the parking area. Mayapple Hill Road is a one-way only road that leads from Northfield Avenue and runs north to the parking area. The second access is via Cedar Avenue that leads from Pleasant Valley Way. This road is two-way until directly north of the parking lot. At that point, inbound traffic is split to the south where it becomes a one-way road that leads into the parking lot. Traffic exiting the parking lot follows a long winding road that follows that runs clockwise and forms a loop that connects back with Cedar Avenue where it becomes two-way again. This is the only vehicular exit.



Figure 70 – Mayapple Hill parking lot.

The parking lot is asphalt paved and edged with Belgian block curbing. The lot is not striped and there are no provisions for ADA accessible parking spaces. The parking lot is comprised of two double loaded bays separated by a paved central island. Based on the size of lot, approximately 100 vehicles.

There are several pedestrian walking trails in this area. There is a blazed trail that forms a loop around the main use area starting at north end of the parking lot and ending at the south end of the parking lot. This loop is a popular walking path and also serves as access to the picnic area. Another path divides the area in half and leads from the south of the parking lot and heads west where it meets the blazed trail. This path provides access to the athletic field and is also part of the Lenape Trail.

Structures

The north picnic area contains a covered shelter and a restroom facility. The size of the structure matches the original shelters of the reservation, however the material is different. The shade structure is approximately 21 feet wide and 31 feet long. The vertical posts are 5” square set on concrete footings. The corners of the structure are formed by a group of three posts. The posts support a corrugated metal over wood frame roof. There is an 11” wide bench around the inside of the shelter. A 1”x5” rail forms the back to the bench. Overall the shelter is in good condition. The bases of some post are splitting.



Figure 71 – Original shade structure with new roof. Internal bench is missing.

The south picnic area contains a covered shelter and two portable toilets. The shade shelter is one of the original historic shelters. It is approximately 21 feet wide and 31 feet long. It is constructed of 12” diameter timber posts 9’-6” on center supporting a corrugated metal over wood roof. Three rows of



Figure 72 – Mayapple Hill shelter showing massing similar to original design with different material.

4x6” timber rails enclose the structure with an entrance opening in the west face. The posts are set in a stone masonry foundation that forms a two-foot wide rectangle around the base of the structure. Inside the shelter, there is no floor other than exposed dirt. Generally, the structure is in good condition. The middle rail in the section to the right of the entrance is missing. There is a chunk of stone missing from the foundation at the entrance. The bases of the posts are suffering termite damage or rot.

The restroom in the north area is masonry block structure approximately 16 feet by 33 feet. The building has a white stucco finish. The men and women’s facilities are accessed through doorways on the narrow ends of the building. Doors on both sides of the long face of the building access storage rooms. This building appears to be one of the only functioning facilities of the reservation. The interior of the building has deteriorated and the fixtures need to be replaced. The building overall appears to be in good condition.



Figure 73 – Mayapple Hill restroom facility.

Furnishings

The furnishings in this area consist of picnic tables, barbeque grills, trash receptacles, drinking fountains and players benches associated with the softball field. All the picnic tables are 12 feet in length and are constructed to resemble to the historic tables in the reservation. However, instead of mortared stone bases, they are constructed of concrete with a stone pattern scribed into the concrete. There are 12 tables each located in the north area and the south area. All the barbeque grills are stone fireplaces approximately one foot high. There are four grills in the south area and three in the north area. There are six trash receptacles in the south area and seven in the north area. Each area contains one drinking fountain. The drinking in the fountain in the south area was damaged with a large hole in one side and was not operational.

The softball field in the center of the area includes four player’s benches, two for each side, and a chain link backstop. The player’s benches are six-foot long solid wood seat and back with metal frame and support post. The benches have a 18” seat height. The benches show signs of splitting on the seat surface and should be replaced. The backstop is generally good condition with no bent poles or holes in the mesh.

Lighting and Signage

Signage in this area consists of regulatory signs (use permits, vehicular access) and general traffic and roadway signage. There is no lighting in this area.

12.27 Turtle Back Picnic Area

General Overview

The Turtle Back Picnic Area is located at the northeast corner of South Mountain Reservation, just south of Northfield Avenue. The area was once the work camp for the Civilian Conservation Corps. All the structures and features related to the camp have been removed and the area has been converted into a picnic area and open recreation field. The area has parking, restrooms, picnic tables, and serves as a trail for the Longwood Trail, the Turtle Back Trail, and the Orange Blaze trails. Turtle Back Rock is located in this area, north of the picnic area. It is accessed via the Turtle Back Trail. The name of the Turtle Back Picnic area, Trail, and the Turtle Back Zoo is derived from the rock, which has markings on it resembling a turtle's shell.



Figure 74 – Turtle Back Picnic Area. Showing the location of the Civilian Conservation Corp campsite.

Turtle Back is a popular area for various activities. The area provides a large picnic area, a large field utilized by dog owners and access to many trails. The parking lot provides access for people look for Turtle Back Rock. A softball field also provides recreation. Schools utilize the picnic area as it provides room for buses and is in close proximity to Turtle Back Zoo. Restroom facilities are provided by portable toilets because the restroom building is not operational.

Parking and Circulation

Vehicular access is via a driveway off of Walker road, which is residential street that intersects Northfield Avenue with a signalized intersection. The parking lot is separated into two separate areas with a small area accommodating approximately ten vehicles and the larger area accommodating approximately 40 to 50 vehicles depending on they are arranged. The parking spaces are not delineated by striping so there is no organization to the parking layout. There are no designated ADA accessible parking spaces.



Figure 75 – Turtle Back Picnic Area parking.

There are several pedestrian trails that originate at the parking areas. The Longwood Trail starts the southwest corner of the main lot and heads south towards the Girl Scout camp.

Structures

There are two structures located in this area, a restroom and a shade shelter. The restroom is a masonry structure 16 feet wide and 40 feet long. It contains a men's room, women's room and two storage rooms. The building appears to be in good condition. However, the building is currently closed for unknown reasons. Three portable toilets including one ADA accessible unit are provided.



Figure 76 – Turtle Back Picnic Area restroom facility provided by porta-johns as the building does not function.



Figure 77 – Turtle Back Picnic Area shelter.

The shade shelter is approximately 20 feet long by 16 feet wide. It is supported by 5"x7" rectangular painted metal posts eight feet on center on the long side and 12 feet apart on the ends. The roof is asphalt shingles over wood sheathing and is supported by wood rafters. The shelter has no structured floor surface and is simply exposed earth. Overall the shelter is in good condition and the only noticeable deterioration is where the paint on the post has peeled and rust has formed. All post show signs where paint has flaked off and has been painted over.

Furnishings

The furnishings in this area consist of 10 picnic tables, 16 barbeque grills, and a total of 36 trash receptacles (23 in the picnic area, 6 for the open field, and 7 adjacent to the parking lot) and player benches for the baseball field. There are two types of picnic tables in this area. Five of the tables are eight foot, all wood tables, and five are eight foot long with wood tops and seats with curved metal tube support frame. Fourteen of the barbeque grills are single grills, pedestal mounted while two are double-wide grills (pedestal mounted).

Lighting and Signage

There is signage on Northfield Avenue directing visitors to the area. Within the area itself, there is only a sign of park rules and a trail marker for the Turtle back trail. There is no lighting for this area.

12.28 Turtle Back Rock

The basalt in the northern section of the Reservation has created an interesting formation that has drawn people from the early 20th Century. As the lava was cooling the basalt formed crystal formations with gaps between the formations. The gaps filled with sediment over time. The final shapes look like a turtle's back. Turtle Back Rock can be accessed from the Turtle Back Interpretive trail and North Trail. There is no interpretive signage about the formations.



Figure 78 – Turtle Back Rock showing basalt-cooling pattern that looks like a turtles back.

12.29 Turtle Back Zoo

The Turtle Back Zoo is located on the south side of Northfield Avenue behind the Essex County Richard J. Codey Arena. It was first opened to the public in 1963. The Zoo encompasses approximately 15 acres and sits in historic Oak Field. A master plan was completed for the Zoo in 2000.

The Zoo consists of: an Entrance Plaza, An Amphitheater, a picnic area, Turtle Back Junction Train, numerous exhibits including the Essex Petting Farm with a pony ride, a small gift shop, and site furnishings. A portion of the Turtle Back Junction Train runs on the Orange Reservoir property. There were over 200,000 visitors in 2005.

The County just completed a 6000 square foot state-of-the-art veterinary animal hospital. In addition improvements were made to the farm exhibit and a new 18,000 square foot Black Bear Exhibit was completed. A 10,000 square foot Reptile and Education Center is under construction. Further improvements are being completed in order for the facility to become accredited by the American Zoological and Aquarium Association.

12.30 Essex County Richard J. Codey Arena

The Essex County Richard J. Codey Arena is located on Northfield Avenue just east of Cherry Lane and adjacent to Orange Reservoir. It sits next to the Turtle Back Zoo. The Arena consists of two indoor ice skating rinks. The arena is used by the NJ Devils for practice and for special events. Recent improvements include a new lobby area, front façade and landscaping. These were the first improvements to the facility in its 40-year history. A 500-space parking garage facility with a police substation was constructed in the location of the old parking lot. A master plan for the facility is currently being completed.

SOUTH MOUNTAIN RESERVATION

LANDSCAPE AND INFRASTRUCTURE ASSESSMENT AND RESTORATION MANAGEMENT PLAN

Legend

Historic Trail Network

— Pedestrian trails

— Pleasure Drives

— Thru-Roads

Vistas

(Broad Vista

(Broad Vista (Existing)

(Narrow Vista

(Narrow Vista (Existing)

Existing Trails

— Footpaths

— Rahway

— Lenape Trail

— Oakdale

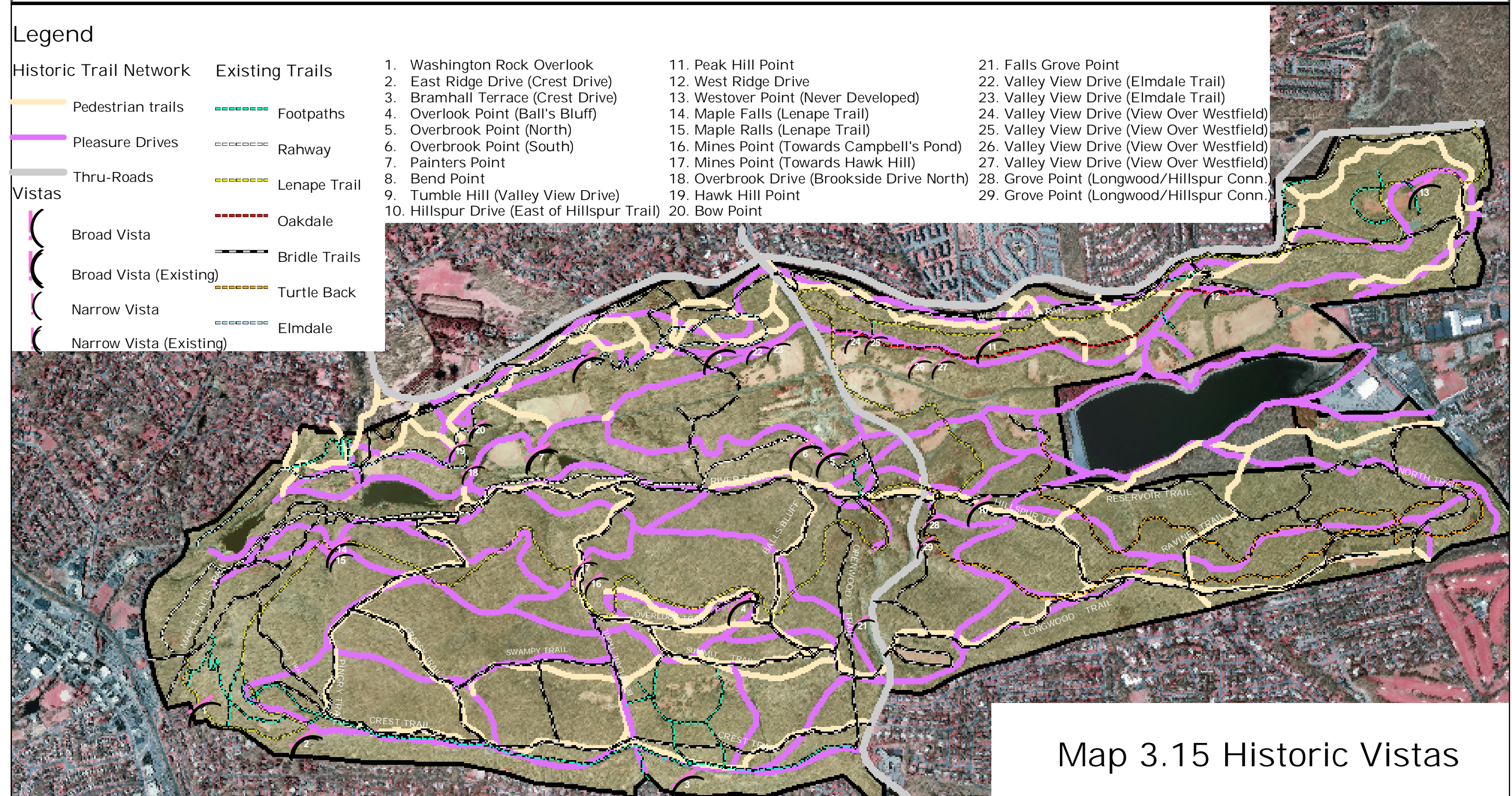
— Bridle Trails

— Turtle Back

— Elmdale

1. Washington Rock Overlook
2. East Ridge Drive (Crest Drive)
3. Bramhall Terrace (Crest Drive)
4. Overlook Point (Ball's Bluff)
5. Overbrook Point (North)
6. Overbrook Point (South)
7. Painters Point
8. Bend Point
9. Tumble Hill (Valley View Drive)
10. Hillspur Drive (East of Hillspur Trail)
11. Peak Hill Point
12. West Ridge Drive
13. Westover Point (Never Developed)
14. Maple Falls (Lenape Trail)
15. Maple Ralls (Lenape Trail)
16. Mines Point (Towards Campbell's Pond)
17. Mines Point (Towards Hawk Hill)
18. Overbrook Drive (Brookside Drive North)
19. Hawk Hill Point
20. Bow Point

21. Falls Grove Point
22. Valley View Drive (Elmdale Trail)
23. Valley View Drive (Elmdale Trail)
24. Valley View Drive (View Over Westfield)
25. Valley View Drive (View Over Westfield)
26. Valley View Drive (View Over Westfield)
27. Valley View Drive (View Over Westfield)
28. Grove Point (Longwood/Hillspur Conn.)
29. Grove Point (Longwood/Hillspur Conn.)



Map 3.15 Historic Vistas

INFORMATION SOURCES: NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF GEOGRAPHIC INFORMATION SYSTEMS

<http://www.nj.gov/dep/gis/index.html>

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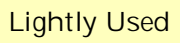

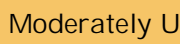




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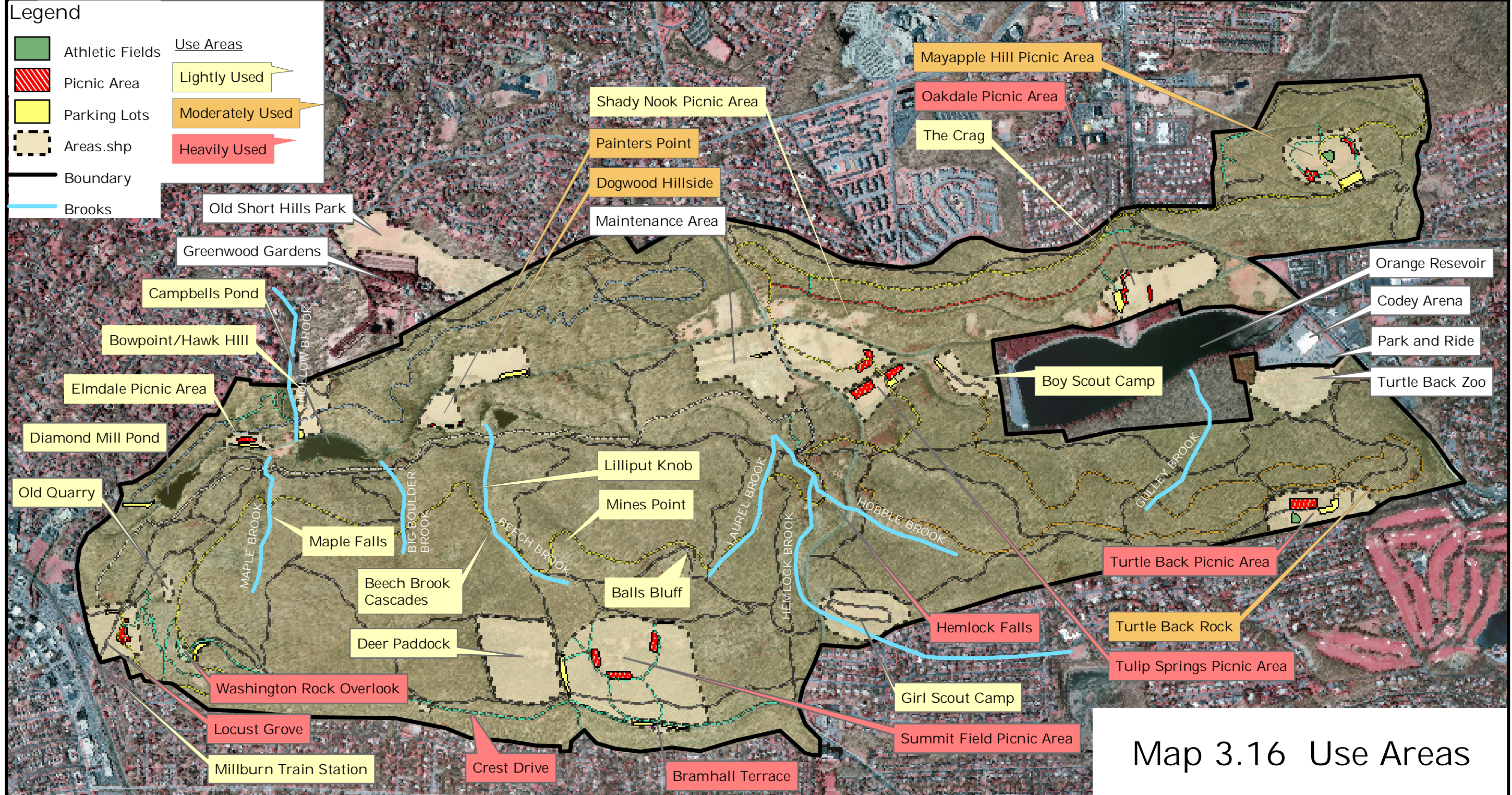
PPE
PROFESSIONAL PLANNING
AND ENGINEERING CORPORATION

SOUTH MOUNTAIN RESERVATION

LANDSCAPE AND INFRASTRUCTURE ASSESSMENT AND RESTORATION MANAGEMENT PLAN

Legend

- | | | |
|---|-----------------|---|
|  | Athletic Fields | Use Areas |
|  | Picnic Area |  |
|  | Parking Lots |  |
|  | Areas.shp |  |
|  | Boundary | |
|  | Brooks | |

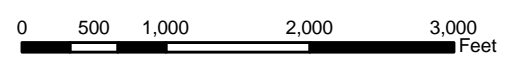


Map 3.16 Use Areas

INFORMATION SOURCES: NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF GEOGRAPHIC INFORMATION SYSTEMS

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SOUTH MOUNTAIN RESERVATION

LANDSCAPE AND INFRASTRUCTURE ASSESSMENT AND RESTORATION MANAGEMENT PLAN

Mayapple Hill
 1. Shade Shelter
 2. Rest Room
 3. Shade Shelter (Historic)

Oakdale
 4. Equipment Shed
 7. Abandoned Building
 6. The Crag (Historic overlook)
 7. Rest Room (Closed)
 8. West Orange Sanitary Pump Station

Nodding Woods
 9. Shelter Remnant
 10. Abandoned Building (Historic)

Shady Nook
 11. Shelter Remnant (Historic)
 12. Shade Shelter

Tulip Springs
 13. Shade Shelter
 14. Rest Room
 15. Shade Shelter

Boy Scout Camp
 16. Well #6 (City of Orange)
 17. Water Tower (City of Orange)
 18. Cabin and Outhouse

19. Cody Arena
 20. Turtle Back Zoo
 Turtle Back Picnic Area
 21. Restroom (Closed)
 22. Shelter

Girl Scout Camp
 23. Cabins and Outhouses

Maintenance Area
 24. Administrative
 25. Salt Silo
 26. Garage

City of Orange
 27. Well #4
 28. Well #3

Painter's Point
 29. Well #2 (City of Orange)

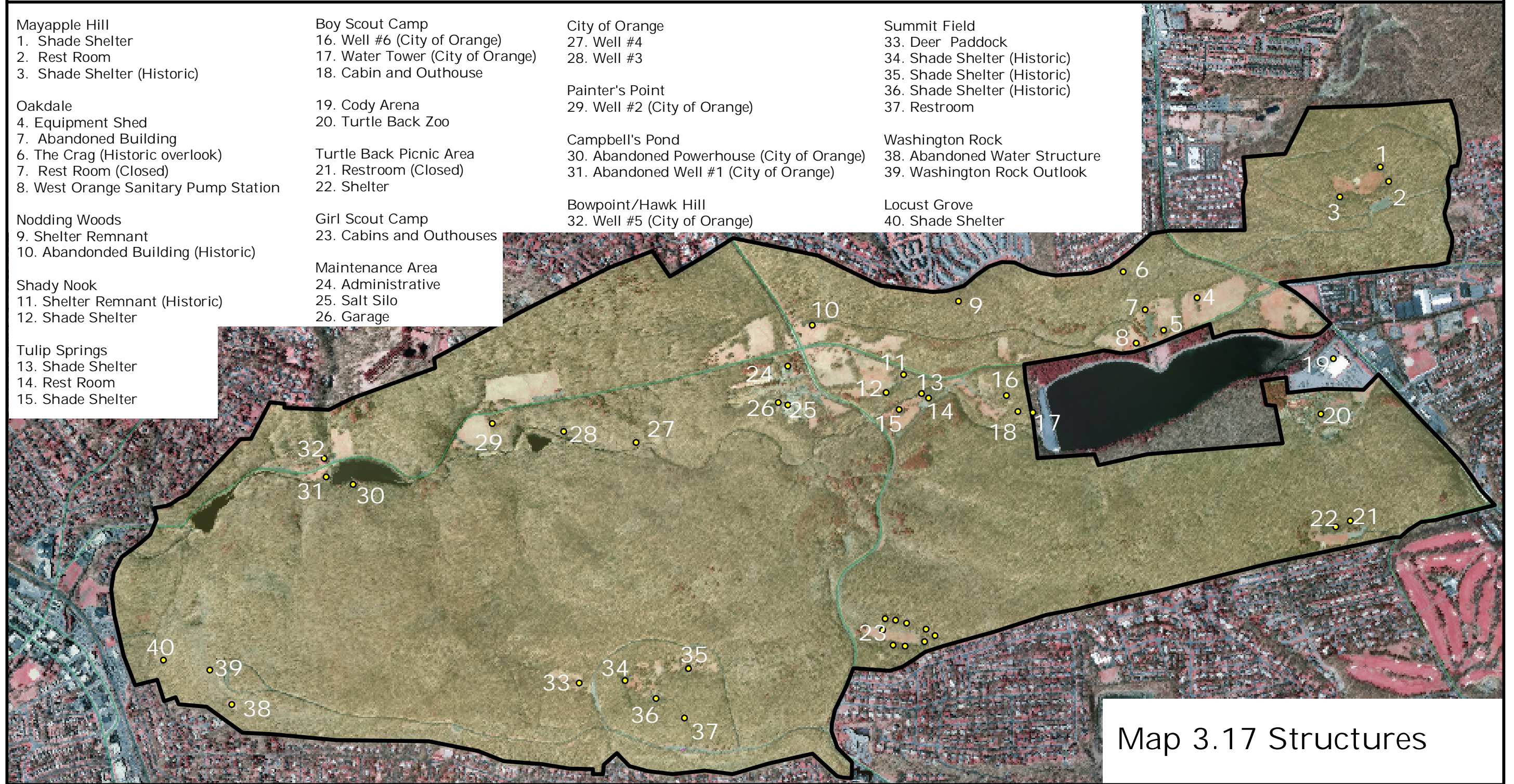
Campbell's Pond
 30. Abandoned Powerhouse (City of Orange)
 31. Abandoned Well #1 (City of Orange)

Bowpoint/Hawk Hill
 32. Well #5 (City of Orange)

Summit Field
 33. Deer Paddock
 34. Shade Shelter (Historic)
 35. Shade Shelter (Historic)
 36. Shade Shelter (Historic)
 37. Restroom

Washington Rock
 38. Abandoned Water Structure
 39. Washington Rock Outlook

Locust Grove
 40. Shade Shelter



Map 3.17 Structures

INFORMATION SOURCES: \NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION\BUREAU OF GEOGRAPHIC INFORMATION SYSTEMS

<http://www.nj.gov/dep/gis/index.html>

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13.0 EXISTING MAINTENANCE

The current maintenance of the Reservation is primarily the responsibility of the Essex County Department of Parks. Reservation maintenance is done by a six-person crew working out of the maintenance facility located in the Reservation. The 6-person crew is responsible for maintenance of South Mountain Reservation as well as Riker Hill, Environmental Center, and Becker Farm.

The maintenance crew consists of:

- 1 – Working foreman;
- 2 – Laborers;
- 2 – Grounds keepers;
- 1 – Heavy equipment operator
- 1 – Part-time staff

About 25% of their time is dedicated to maintenance work in the Reservation. Total estimated hours for existing maintenance of the reservation is shown in Table 4 below. Staffing levels have remained fairly stable during the last 3 three years. Six to eight years ago, 10 full-time employees worked out of SMR.

Total Available Hours	
6 FT staff x 8 hrs/day 261 days/year	12,528 hrs
Part-time staff	2,080 hrs
Total Available Hours	14,608 hrs
Time Available for SMR Maintenance	
25% of total time	3652 hrs
	1.7 FTE
Deductions from Total Available Hours	
Vacation, holidays, sick time, etc. @ 400 hrs/FT employee	600 hrs
Non-Productive Time: Change/wash-up, waiting for vehicles, inclement weather, etc, 260 hrs/employee	455 hrs
Net Available Time	2,597 hrs

Table 4 ~ Staff hours available for South Mountain Reservation

13.1 Existing Maintenance Work

Most of the work currently done in SMR is limited to mowing, delimiting and cleaning. There is no regular woodland management, trail repair or erosion control work being done by the County maintenance staff. In addition, County staff are not properly trained to do removal of invasive vegetation or other kinds of ecological restoration work that is very different and requires different training than other kinds of more typical park maintenance work. Work done in the woodlands is predominately on an emergency basis such as removal of a down tree blocking a trail or is focused on those areas that are heavily used such as the picnic areas.

13.2 Equipment

Existing equipment for maintenance of South Mountain Reservation includes: small tools and hand tools, backpack blower(s), mower, flail mower, backhoe/front end loader

13.3 Comparisons with Other Parks

Most of the parks that we contacted for this project do not have dedicated staff or budgets for work in their woodlands, so therefore it's very difficult to get actual costs for woodland maintenance in other parks. Most woodland work is either done by Rangers and is limited to tours and some clean-up days or is emergency-related, such as removal of a downed tree across a trail or a trail wash-out. Interestingly, both Central Park and Prospect Park in NYC and the Regional Parks in Pittsburgh have focused woodland maintenance efforts and can account for their costs. Park crews are detailed to the woodlands and do routine maintenance work, such as cleaning, trail repair, removal of invasive vegetation, replanting, small structure repair and erosion control. In addition, both parks use volunteers to supplement their maintenance as well as public programs that take place in the woodlands.

Table 5 below compares the Reservation with maintenance of other park woodland areas. The table shows that currently the County spends \$44.00/acre or \$0.001/square foot maintenance of the Reservation.

Park (Total Acres)	Woodland Acres	Square Feet	Annual Cost	Cost / acre	Cost / sq. ft.	Comments
S. Mountain Reservation (2048)	2,048	89,210,880	\$90,200	\$44.00	\$0.00	
Central Park (843 acres)	97	4,225,320	\$245,000	\$2,526	\$0.060	\$210,000 personnel cost & \$35k OTPS, 1,000 volunteer hrs
Prospect Park (585 Acres)	200	8,712,00	\$800,000	\$4,000	\$0.090	\$800,000 personnel cost, 1,200 volunteer hrs.
Pittsburgh Regional Parks (1,743 acres)	1,800	78,408,000	\$500,000	\$277	\$0.006	
Somerset County Parks (9500 acres)	4,000	174,240,000	\$73,000	\$18.25	>\$0.001	1,000 annual volunteer hours, personnel costs are Ranger patrols, no regular maintenance
Union County Parks	2,000	87,120,000				Negligible annual expense for woodlands

Table 5 ~ Woodland management comparisons

Currently, there are a total of 2,597 hours dedicated to maintenance work in the Reservation. The acres shown are acres of woodlands and not total park acres Total park acres are shown in red. Central Park is 843 acres of which 97 acres are woodlands. The total acres of woodland and maintenance costs were determined by speaking directly with the respect park staff. The costs show below are annual costs of maintenance in the woodlands and does not include park maintenance work outside the woodlands.

Other parks with woodland areas encourage a number of activities including mountain biking, hiking, equestrian trails, etc. Although many park systems are ambivalent about mountain biking, because of the amount of off-trail use and the resultant damage to the landscape. Below are some of the New Jersey, Pennsylvania and New York State Parks we investigated and a list of approved park uses.

13.4 South Mountain Conservancy

The South Mountain Conservancy (SMC) works through the Friends of Essex County Parks, which is a 501(C)-3. The SMC primarily does trail maintenance and other support work such as tours, pamphlets, promotion, etc. for SMR. The SMC “contributes” approximately 300-350 hours that’s broken down as follows:

Trail maintenance – 160 hrs (10-12 volunteers 4x/year @ 3hrs each)
Other support – 150-190 for website maintenance, tours, etc.

13.5 Special Events

SMR is the site of up to six annual special events: Essex County Fair, Carnival, Jewish Festival, Mid-evil Times, Other

Up to six extra staff are detailed from other parks to help with the special events – cleanup, setup and takedown.

New York State Parks	Acres	Trail Miles	Mtn Biking	Equestrian Trails	Comments
					72 of the 170 State parks permit mountain biking
Pennsylvania State Parks					
State Parks					Equestrian & motorized vehicles prohibited
Raccoon Park	7,572	17	x		
Morraine Park	>3,225	7	x		
Blue Knob State Park	5,874		x	x	
Ohiopyle State Park	19,052	27	x		
Shawnee State Park	3,983	7.5	x		
Codorus State Park	3,329	6.5	x	x	
French Creek State Park		23	x	x	
Gifford Pinchot State Park	2,338	4	x	x	
Many other State Parks permit mountain biking					

Table 6 ~ New York State Park Use Comparison with South Mountain Reservation

New Jersey Parks	Acres	Trail Miles	Mtn Biking	Equestrian Trails	Comments
Passaic County					
Garret Mountain Reservation	568		x	x	
Rifle Camp Reservation	181		x		
Sand Cap Park	219		x		
Apshawa Preserve	501		x		
Morris County					
Lewis Morris Park	1,154	9.2			
Mahlon Dickerson Reservation	3,200	20			
Patriots Path		>18	x	x	Paved Pathway
Pyramid Mountain Historical Area	1,300				No mountain biking or equestrian uses
Schooley's Mountain Park	797		x	x	
Union County					
Watchung Reservation	2065			x	Mountain Biking prohibited on trails.
Bergen County					
Overpeck Park				x	Currently not addressed, but mountain biking will be prohibited.
Saddle Ridge Park				x	
Somerset County					
Washington Valley Park	705	7	x		
Sourland Mountain Preserve	2,870	6.3	x		

Table 7 ~ New Jersey State Park Use Comparison with South Mountain Reservation

CHAPTER 4

Landscape and Infrastructure Restoration Management Plan



Chapter 4 – Recommendations

1.0 DESIGN GUIDELINES

Because the Reservation is a large and complex landscape, improvements are suggested over a ten-year period. It is therefore recommended that a coherent set of Design Guidelines be prepared as a first year task. Over the upcoming years, these Guidelines can direct the work of various landscape architects, engineers, foresters, architects, County maintenance personnel and volunteers in the appropriate design of the landscape and the facilities inserted into it. Thus, the style and materials of construction will be readily understood and can be applied to the Reservation over many years. Descriptions, scale drawings, historic photographs, plant lists and material lists should be contained in the guidelines and should be used as a reference for future work at the Reservation.

The Design Guidelines should include:

Structures

Picnic shelters
Façade treatment
Rooflines and roofing materials
Fenestration
Bridges
Culverts and other drainage structures
Overlooks

Wayfinding System (using County standards)

Size hierarchy for various purposes
Color and material of signs
Letter font and hierarchy

Landscape Elements

Stone type and jointing for various uses (cobble, walls, drainage courses)
Road surfaces
Path materials, cross section, and edges
Stairs for various conditions
Handrails, guardrails, and fencing
Bollards
Bicycle racks

Trash Receptacles (County standard)
Picnic tables
Fireplace and grill structures
Benches (County standard in general; special where appropriate)
Drinking fountains
Light fixtures (County standard in general; special where appropriate)
Various swale edges and water courses

Vegetation Management

Plant lists based on the records of Olmsted Brothers
Native plantings for various purposes
Establishment of new meadow edges and meadow installation
Management for reestablishment and maintenance of vistas

2.0 AESTHETIC FORESTRY

It is clear from analyzing the history of South Mountain Reservation that the site-wide program of forest management defined by the Olmsted firm did not succeed. After more than 25 years of the firm's attempts at detailed plantings and clearing, the task was clearly too ambitious to be realistic. Although there are many principles described by the firm that could and should be implemented, they should be done very selectively, in areas related to facility improvements and along highly used roadways. Such forestry, which would include selective clearing for vistas, planting of evergreen species to increase woodland diversity, and enhancement of under story vegetation, should be done on a 'project by project' basis as funding allows. This approach would allow the scenic quality, so strongly defined in the Olmsted plans for the Reservation, to be successfully implemented and managed in selected areas, so that the effect could be affordable and manageable. The Inventory Section of this report describes the areas in detail.

In addition, it is recommended that areas designated on the Olmsted plans as open spaces, especially on ridge tops, be cleared and the meadow acreage increased to more closely follow the Olmsted plans. An opportunity exists in these upland open areas to establish shallow meadow bio-retention areas to capture and detain storm water to reduce erosion and drainage structure needs downstream in the lower elevations of the park. This has been done very successfully in other Olmsted parks such as Iroquois Park in Louisville, Kentucky. Possible project areas for such a solution are the Summit Field area and the West Fields area. Currently, stepped pools within the drainage courses, have been suggested to provide similar benefits.. Chapter 4 Aquatic Ecology section describes this in more detail. Additional consideration and evaluation would be needed to determine feasibility of meadow bio-retention areas.

2.1 Infrastructure Treatment

The following are treatment guidelines for the Reservation's various elements.

View Areas

Remove invasive vegetation, and selectively remove trees, and/or prune specific tree limbs that are obstructing views. Under-plant these areas with vegetation specified in the Olmsted plans and plant lists, that are primarily native, non-invasive, commercially available, and that are of low attraction to deer. Ground plane surfaces should be planted with low native grasses to reduce the development of invasive species. Clear cutting of these areas is unacceptable as is chipping cut debris for use as mulch. Along the City of Orange Reservoir, selected vistas of the water from the road edge should be re-opened. The Olmsted design included a completely open view along the entire edge of the lake, now virtually obscured by second growth woodlands. (See below for issues related to fencing along the reservoir).

Road Edges

Selectively clear vegetation from road edges, and plant 3-foot shoulders of native grasses that can be mown twice each year. In areas visible from roads, and all public gathering points, cleared shrubs and invasive materials need to be removed to an area not visible by the public from the roads and gathering points. Felled trees should be removed to an area not visible by the public from the areas mentioned.

Invasive Vegetation

Invasive plants should be removed on a project-by-project basis, when facilities are being improved, in areas highly visible from main roads, and at park entrances. Federal, State, and private funds should be sought under existing grant programs to assist in financing this effort with a long-term goal of reservation - wide invasive vegetation management.

The Rhododendron Collection

Preserve and protect the Rhododendron plantations. Add new Rhododendrons per the Olmsted design. New plants should be added on a regular basis, every 3-5 years, to keep the collection intact as older plants decline and die.

Planting Design for Rehabilitated Areas and New Facilities

In designing plantings for rehabilitated areas, they should be designed with the concept of 'framing' any new elements, so that they blend into the landscape as quickly as possible. Ornamental plantings, such as annual flowers, ornamental grasses, and plantings not in keeping with the Olmsted plant lists, should be avoided. Utilize plan 45 and 68 and their respective planting instructions, as well as the Reservation Chronology Report, to determine the specific plant material to be utilized and the design intent at each location.

Roads and Paths

Access for the public was a common thread in all of the work of the Olmsted firm. At South Mountain Reservation, create additional access through rehabilitation of one of the east-west paths into a limited use, vehicular accessible, stabilized path accessible to handicapped persons. This should be provided in order to make the Hemlock Falls area, the Balls Bluff, and Mine Point sites accessible to all users. These scenic areas, now available to enjoyment primarily by able-bodied users, could effectively be made accessible to a broader public, also improving security within the park and supervisory access within its interior areas.

Retaining Walls, Drainage Swales, Culverts, Bridges

Structures remaining in the Reservation, and built during the period of the Olmsted firms' involvement and during the CCC era should be considered to be historic. These should be protected, preserved, or rehabilitated where needed. Any new infrastructure should be designed in accordance with these historic precedents. Drawings and photographs can supplement analysis of existing historic structures. Materials, including color, shape, finish, jointing, and joint medium should match historic structures as closely as possible. Drainage

swales should be graded swales reinforced with large boulders or rusticated stone when in need of reinforcing.

In interior areas of the park, where scenic effects are critical to the historic design of the Reservation, such as at Hemlock Falls, drainage ways should be designed to appear as naturalistic rock outcrops, using large boulder stone of native material to match visible natural outcrops, and inter-planted with plantings as described above. The 'Ramble' in Central Park, and the 'Ravine' in Prospect Park, both in New York City, are good examples of this approach, very typically used by the Olmsted firm throughout its existence. Loose riprap is not an aesthetically appropriate material for a historic park such as South Mountain Reservation. It may be used as drainage channel material at specifically designated maintenance areas and where no other treatment is feasible. Where it is used, it should be of rough stone, minimum 12" diameter, and of a color matching native local bedrock. See Chapter 6 for criteria for use.

Fences and Railings

Fences and railings should be designed in accordance with those seen in historic photos of the Reservation. Chain link fencing should not be used in the park except at maintenance areas not visible to the public. Fencing along the South Orange Reservoir visible from the park road should be of ornamental metal, and not chain link, so as to be in keeping with the visual quality of an historic park.

Benches, Trash Receptacles, Drinking Fountains:

County standard benches, trash receptacles, and drinking fountains should be used in areas to be rehabilitated, where historic fabric is missing, or in areas where facilities are being expanded or newly added. Where historic fabric exists, particularly where there is photographic evidence, it should be replaced in kind to the greatest extent possible.

Lighting and Signage

County standard light fixtures should be used consistently throughout the park. Roadway light fixtures should be replaced over time with the County standard decorative fixture to enhance the scenic quality of the park and to increase the sense that it is being cared for. Signage should be kept to the minimum needed and should be developed with a clear and consistent hierarchy of sizes for various functions. A consistent language of form, color and graphic design should also be developed for the park. All entrances to the park should be clearly marked with such consistent signage.

3.0 FOREST AND MEADOW ECOLOGY

3.1 Management Tools for the Forest Ecosystem

The original Olmsted vision for the Reservation included maintaining the area both as a healthy ecosystem and as an aesthetic and educational resource. The native vegetation augmented according to the Olmsted aesthetic principles was to provide textural diversity for its own sake and as a backdrop to frame the significant vistas contained within the Reservation and looking outward. Maintaining the Reservation for aesthetic purposes requires a great deal of maintenance or, as referenced earlier, in the words of Frederick Law Olmsted “judicious use of the axe.” However, at the current time, maintenance and management of this important resource is limited due to economic constraints. Therefore, management of the forest ecosystem and enhancing the ecological and aesthetic strengths associated with this system need to be tied together with the economic constraints. In addition, the management plan must be adaptive, focusing on the diversity, connectedness and dynamics of the Reservation with the surrounding communities.

The location of the South Mountain Reservation, within the New York metropolitan area, can make a difference in the quality of life of those who live in the surrounding area. As the surrounding area continues to experience further development, the Reservation will become even more significant while becoming even more affected by outside influences. To manage these continued and potentially growing influences on the park, management plan options have been developed. As previously stated, there is no one factor contributing to the forest health and aesthetics and therefore no one tool should be used to manage the Reservation’s forest ecosystem. Rather, the following options can be used in varying degrees, dependent on the budget allocated for Reservation management in any particular year and the degree to which a particular area or problem is perceived to be a priority.

The key characteristics that have been identified in the South Mountain Reservation and are the focus of management efforts include diversity, connectedness, and dynamics.

The South Mountain Reservation is a complex landscape pattern, and includes a wide range of tree species and sizes, ground covers, soil types, microclimates, wildlife, people, buildings, and infrastructure. However, increased development in the area, unmanaged disturbances within the Reservation, and growing pressure by non-native species are affecting the diversity within the Reservation.

In addition, the Reservation is connected to the surrounding communities in many ways – through the roads, homes and other infrastructure located in and around the park. This connection will likely grow in the future as development and populations continue to grow in the surrounding areas. The Reservation is also hydrologically connected with the surrounding area, through the streams and creeks that flow into, through and out of the Reservation.

Lastly, similar to all forests in this region, the South Mountain Reservation has undergone significant changes over the past 100 years due to both the slowly changing ecological factors and the much faster human-induced factors. The Reservation will continue to experience change as time goes on, and the management plan to be undertaken by the County must adapt to these changes.

The management plan should recognize this diversity and complexity, and be undertaken in such a way that it is understood that no one option will maintain the overall ecological and aesthetic integrity.

The forest and meadow management tools include:

- Deer Control
- Erosion Control
- Forest Regeneration
- Invasive Species Management and Pest Control

Each option is described more fully below.

3.1.1 Deer Control

Deer and its affects to the forest ecosystem and potential management options are fully described in the accompanying report, “South Mountain Reservation Ecology and Deer.” The management options are briefly summarized below. The full report can be found in Appendix H.

From a population reduced to a handful of deer in the early 1900s, the deer have rebounded within Essex County during the latter part of the 20th century. A deer survey conducted in March 2004 revealed a population density of 63 deer per square mile, or roughly 200 deer (Predl 2005). Since then, the females have given birth to one to three fawns, raising the possible number of deer to 300, or 93 deer per square mile. These populations have been browsing on the understory of the forest at levels that are changing the vegetative species composition and disrupting the natural landscape, the visitor’s visual experience, and historic scene value of many areas.

The impact of a high deer population on the forest vegetation within the Reservation is largely evident in the understory layers where they have the highest and most immediate impact. Within most areas of the Reservation, the dense vegetation layer, presence of tree seedlings, forbs, shrubs, and wildflowers, even the accumulation of fallen leaves that forms much of the litter layer on the forest floor, has largely disappeared. Areas exist where trees are dying and are not regenerating largely due to browse of new seedlings. The areas with the most abundant understory are the areas containing freshwater forested wetlands and areas dominated by an invasive understory, typically in areas where the tree canopy is thin or nonexistent.

Studies conducted in national forests in Pennsylvania suggest deer densities in excess of 20 deer per square mile will prevent natural forest regeneration. Thus 235 (or 73 deer per square mile) need to be eliminated in South Mountain Reservation, by lethal or non-lethal methods, to secure an optimal deer density.

Based on a review of available deer management options, including fencing, repellent use, and habitat modification, the option viewed as the most feasible and economically viable is controlled hunting. Controlled hunting is a deer management option that even groups viewed as anti-hunting are beginning to endorse such as The Nature Conservancy, the Audubon Society, and the New Jersey Conservation Foundation. Many resource agencies believe that the tight limitations applied to hunters, the only major predator of deer outside of large wilderness areas, have unfortunately resulted in forest conditions that are perfect for explosions in deer populations. Controlled hunting could potentially add revenue to the County through hunting licenses and fees, and potentially providing a source of meat to food banks. Sharpshooting can also be considered a cost-effective deer management option. The concept of using trained professionals to control deer populations in a controlled setting has been successfully adopted by communities such as Millburn, Summit, and Princeton, and has been implemented in large public areas like Watchung Reservation in Morris County.

Complete habitat modification is an unrealistic deer management option that cannot be implemented without causing extensive damage to the forest ecosystem of the Reservation. As deer can only affect the understory, large amounts of herbicides would have to be used to eliminate the palatable vegetation and replace with undesirable shrubs. In addition, the whole procedure would require great caution that invasive species do not seed into the area and dominate the understory. However, habitat modification at specific areas, tied together with ongoing maintenance activities, can be accomplished. For example, when an area is cleared for construction purposes, rather than just allowing the area to naturally vegetate, native vegetation rarely damaged by deer could be planted (such as Arrowwood or Silky Dogwood).

Repellent use throughout all of the South Mountain Reservation would also be largely ineffective. The costs associated with applying repellents to such a large area could be too great for Essex County and surrounding communities. In addition, the high volume of residents and domestic animals that visit the area can have physiological reactions resulting from exposure to the applied chemicals either through direct contact to targeted vegetation or through aerosol material in the air. However, small areas where vegetation protection is warranted for a particular reason (e.g. establishment of vegetation in a highly erodable area).

Fencing, according to calculated costs, is an expensive deer management option. Under the assumption that a majority of the Reservation would need to be fenced to control deer migration, the sheer cost alone could be too great. In addition, extensive fencing would affect the aesthetic value of the Reservation.

Allowing the deer to remain will continue to perpetuate larger deer herds and increase chances that forest regeneration efforts will not be successful. In addition, impacts to the surrounding areas outside of the Reservation will continue to arise.

Trapping and translocation may be humane, but can quickly become cost-prohibitive once considerations about gas prices are taken into account due to the long haul distances required since Rutgers University, which accepted trapped animals in the past, no longer accepts deer.

Contraception is a high cost whose overall results are still unknown. In addition, current federal regulations governing use of sterilization materials could increase the time contraceptive tools are made commercially available.

Trapping and euthanizing is a quick and humane method of controlling deer populations when a lethal method is required to decrease the population numbers immediately. However, considerations of drug costs and veterinarian fees may dissuade fiscally-strapped communities from implementing this option. A penetrating captive bolt gun or gunshot is also approved if the animal is restrained for accuracy.

It is clear that if no deer management is undertaken, the health of the reservation will continue to deteriorate. The surrounding community will also be affected by this continued deterioration. It is recommended that the County undertake controlled hunting over a period of a few days in the fall each year, on into the future, along with continued annual deer counts. These activities should be maintained as long as deer continue to use the Reservation without any predators to manage the number of deer at a sustainable level for the Reservation. The costs to the County will be minimal. In addition, a combination of habitat modification, fencing, and repellent use can be incorporated to address the issue of restoring the forest ecosystem within the Reservation once the immediate problem of large deer numbers is addressed through controlled hunting or sharpshooting. This combined form of deer management, supported by periodic hunts would have to be instituted on a relatively smaller scale and over a longer time frame to completely maximize restoration efforts.

3.1.2 Erosion Control

Erosion within the forest ecosystem is occurring in areas of highly erodable soil, areas with a lack of soil cover, and in areas with steep slopes, and also along the river due to the natural change in the river alignment and sedimentation. The erosion has become exaggerated in areas where steep ravines are located, and in areas where man-made influences no longer allow for the natural flow of water through the forest. The erosion is causing an instability within the forest ecosystem and is also causing water quality



Figure 79 ~ Erosion occurring on steep slope with little ground cover adjacent to River Trail.

degradation within the West Branch of the Rahway River.

To control the current erosion and prevent future erosion problems, the following maintenance practices should be undertaken on a routine basis.

Culverts and ditches must be kept free of debris and obstructions. The debris should not be side cast if there is a chance it will reenter the system. In areas where regular maintenance is not feasible due to a lack of manpower and resources, areas should be stabilized and, if possible, culverts should be removed and replaced with open ditches that can drain more freely without chance of obstruction.

In some areas, particularly along the Reservoir Trail behind the zoo and Orange Reservoir, the wood road and trail have obstructed flow and scouring on both sides of the trail and road are visible. The road and trail should be regraded, culverts removed, and specific low points reinforced with stone to maintain drainage flow while still allowing access along the road. Also, within this area, there is a large flat section near the southeast end of the zoo where a freshwater wetland area could potentially be located to slow some of the sheet flow and provide water storage. Further investigation of this option is necessary to determine the feasibility by understanding the underlying soils, the potential effects to the surrounding area, and whether the benefits of the wetland creation will indeed slow erosion and improve overall water quality.

Within the southern and western central areas, planting of native, deer-resistant vegetation should be considered. Additional information is needed, due to the lack of soil cover and soil compaction within these areas, to determine the appropriate species. Coupled with these new plantings, dead wood should be staked parallel to the slopes to allow for the natural decaying of the tree and to slow sheet flow down the slopes.

3.1.3 Forest Regeneration

Early successional forest, evidenced by seedling and sapling stands, are lacking in a majority of areas of the Reservation. In addition, within specific areas of the Reservation, particularly within the southern tip, the existing trees all appear to be of similar age. This raises concern about forest regeneration.

To combat this concern, it is recommended that the County utilize the services of an arborist or an Certified Tree Expert. There are a number of professionals hired by the surrounding towns whose employment could be shared by the County. Professional advice concerning forest regeneration be made within the context of the Olmsted plans for these woodlands. The numerous notes on the various Olmsted plans for Job #2128, including plans 45 and 68, as well as the Reseration Chronology developed as a part of this report should be consulted when developing treatment plans for the forest health. These resouces contain a wealth of recommendations for forest management and replanting.

In addition, selective planting within areas of concern should be accomplished. Selected vegetation should be native, diverse, within the parameters of the Olmsted design intent but non-invasive. Until the deer population are brought under control the vegetation should either deer-resistant or protected by tubes and repellent.

Another area of concern is the tree die-off that has been evidenced around the Reservation. In general, the tree die-off has been observed primarily on dry upland ridge areas. It is not known what type of tree is primarily dying off, although a number of oak trees were observed to be in different stages of die-off. In one area that had experienced a die-off and no large trees were still alive, insects were observed on the leaves of the smaller trees still alive.

Further research should be accomplished in the spring of 2006 to determine if the trees are dying as a result of "oak decline." Periodic occurrences of the decline and death of oaks over widespread areas have been recorded within the Mid-Atlantic region over the past 100 years (www.na.fs.fed.us/spfo/pubs/fidls/oakdecline/oakdecline.htm). Oak decline affects more than just oak species and could potentially change the nature of the forest in areas where the natural understory is nonexistent. A study of the die-off should determine whether the die-off is occurring in the red oak or white oak groups – this may help to determine what is affecting the trees and how to combat the problem. Other features that should be checked are whether or not bore holes are symptomatic on the dead and dying trees, and what type of insects are observed on the various trees.

3.1.4 Invasive Species Management and Pest Control

Specific information about the invasive species observed in the Reservation is provided in Appendix A. Priority areas for the treatment of invasive vegetation should be any areas where vegetation will be disturbed due to ongoing Reservation maintenance activities. Immediately following any activities that disturb the vegetation and potentially increase edge habitat or increase light penetration into the forest, the areas should be seeded with an appropriate native grass (and forb, if appropriate) seed mixture and planted with native deer-resistant trees and shrubs. Sources of New Jersey native plants can be found at http://www.npsnj.org/sources_native_plants.htm and one source for native seeds is <http://www.ernstseed.com/Catalog/catalog.htm>.

In the southern section of the Reservation and within upland areas of the central part of the Reservation, within the area mapped as Disturbed Forest, trees appeared to be dying and invasive species were taking advantage of the open light and beginning to dominate the landscape. It appeared that the spread of dying trees was expanding slowly over time. This area should be a priority area for management to determine what is killing the trees (e.g. pests, soil ...). After the diagnosis is made as to what is killing the trees, the area should be treated both for the cause of the dying trees and to remove the invasive species (particularly the Japanese Barberry). Based on the diagnosis, appropriate native deer-resistant vegetation should be planted.

4.0 TRAIL NETWORK

One of the most used and most valuable resources at South Mountain Reservation is the trail system. A system of pleasure drives and trails was an important element that the Olmstead brothers included in the original designs for the reservation as a means to allow access to a variety of scenic opportunities in the Reservation. The pleasure drives were never developed as envisioned and most are now considered part of the trail network. The one road that was developed in this regard was East Ridge Drive (Crest Drive). Valley View Drive is paved but it is closed to vehicles.

The trail network took on a much greater role as the plan was implemented. Without the pleasure drive system, trails became the primary form of circulation. Much of the bridle trail/wood road system aligns with what was originally planned as walking trails. A system of blazed trails not noted on the Olmsted plans currently supplements the bridle trails/wood roads.

In addition to the location of the trails, the natural watercourses, geology and underlying soil condition have contributed to the deterioration of the trails. Water run-off is collected in numerous natural watercourses that drain down to the Rahway River or to Orange Reservoir. The trail system that was built has impeded this flow of water. Areas where water flowed freely were replaced with box and pipe culverts.

The current trail system and the proposed modifications below are based on the constructive elements on the ground. However, it should not be overlooked that the trails were, and are, an integral part of a planned system of experiences. Not only were they intended to provide sure footing, but they were also planned to lead to a range of woodland vistas. Additionally, the trailside vegetation, understory, middle and upper canopy, were planned to add important visual and sensual elements to the trail users' experience.

4.1 Trail Modifications

The change to the original plan has contributed greatly to the deterioration of the current trails. The current bridle trails were never intended to be as wide and prominent as they became. Some trails such as the Openwood Trail and the Sunset Trail were constructed in locations never meant to be trails at all. Other areas of trails were shifted from their proposed alignment. Some were adjusted due to field conditions as noted in the Olmsted correspondence. The Reservoir Trail, however, appears to have been moved from its planned alignment. Historically, this trail was to run in close proximity to the Orange Reservoir. However, it appears that when land was taken by the City of Orange, the trails were moved up-slope to their current position. This places the trails in areas of very steep slopes and coincides with some of the worst erosion on any trails.

4.1.1 Trail Modification Criteria

Historically there was to be a series of pleasure drives and pedestrian trails throughout the Reservation. Due to inadequate funding this was never fully realized. A couple pleasure drives were paved, *East Ridge Drive* (Crest Drive), *Valley View Drive* and *Mayapple Hill* entrance drive and circuit drive. The Mayapple Hill circuit drive, however was not constructed in the location historically planned.

Several of the pleasure drives were constructed but not paved and are currently used as part of the pedestrian (hiking) trail network in the Reservation. These current hiking trails have been given the historic place names of the pleasure drives. These include, *West Ridge Drive* (West Ridge Trail), *Turtle Back Drive* (portion of which is now North Trail), and *Overlook Drive* (Swampy Trail). These are interchangeably called bridle trails and wood roads within this report.

Historic pedestrian trails have been developed to the level of the unpaved pleasure drives. These include the River Trail, Crest Trail, Grassy Trail, Summit Trail, Balls Bluff Trail, Hillspur Trail and the Ravine Trail. These did not have place names noted on Olmsted Plan 68 and were named from nearby features or were not named at all.

A new network of blazed hiking trails was introduced. These are named after nearby historic place names or as the continuation of a county-wide trail, the Lenape Trail. These include the Rahway (white blaze), Elmdale (blue blaze), Oakdale (Red blaze), Turtle Back (orange blaze) and interpretive trail which was indicated by a series of interpretive posts.

The trails were evaluated against the following criteria to determine if modifications were warranted that would address the improvements identified and noted in Chapter 3 Section 9.0.

Improvements with existing configuration

- Maintain width.
- Make improvements to trail surface, drainage structures etc.
- Use when vehicular access (utility, fire, maintenance) is required.
- Use when trail is located where historically planned.

Convert trail from bridle path to hiking trail

- Trail is located where historically planned,
- Vehicular access is not required,
- Trail is suffering from high erosion damage,

Relocate trail

- Trail is not located where historically planned
- Vehicular access is not required, new trail to be hiking path
- Vehicular is required, new trail to be bridle path
- Trail is suffering from high erosion damage

- New alignment can be done in a way to prevent erosion problems in the future
- New alignment provides better access to areas of interest or view points and better user experience
- Use when any adjoining trails can be modified to accommodate new alignment

Remove trail

- Trail is not historic.
- Vehicular access is not required.
- Trail is suffering severe damage.
- Trail provides no access to areas of interest or has little positive user experience.
- Trail is rarely used.
- Circulation can be accommodated via another route.
- Trail follows another trail in close proximity providing no reason for duplicate paths.
- Removal of trail will improve natural overland flow, reducing erosion damage on other trails or improving the ecology of the forest.

4.1.2 Trails Modifications - Removals

Based upon the evaluation of the above criteria in Section 4.1.1 of this chapter the following sections of trail are recommended to be removed and restored to woodland. These locations are presented in Map 4.1. highlighted in red.

Connector trail from Crest trail to Swampy Trail (South of Deer Paddock)

- Trail is not located on historical documents.
- Trail is not highly used.
- Crosses an area of ecologically sensitive wetlands
- Does not provide access to any areas of interest.

Openwood Trail

- Trail is not located on historical documents.
- Trail classified as Moderate improvements
- Circulation can be accommodated by Balls Bluff trail
- Trail disrupts natural water flow. Restoring area would allow water to flow to Hemlock falls

Rahway Trail (portions)

- Trail is not located on historical documents.
- Majority of trail parallels the River trail and is often only several feet away
- Trail runs through very ecologically sensitive areas along the Rahway River, Campbell's pond and Diamond Mill pond.

Sunset Trail Crest Trail to Lenape Trail

- Trail is not located on historical documents.
- Sections classified as major improvement
- Circulation can be accommodated by Lenape trail
- Would help reduce erosion as trail acts as a drainage course

4.1.3 Trail Modifications - Relocation

Based upon the evaluation of the above criteria in section 4.1.1 of this chapter the following sections of trail are recommended to be relocated. This will require the extension of a section of the Ravine trail as par to the relocation. These locations are presented in Map 4.1 highlighted in yellow.

Reservoir Trail

- Area Affected: from south of Turtle Back Zoo to just north of southern end of Orange Reservoir
- Trail is not located where historically planned. Trail has been constructed east and upslope of original design
- Majority of trail classified as major improvements as it exhibits severe erosion

4.1.4 Trail Modifications – Narrow or convert to hiking trail

Based upon the evaluation of the above criteria in section 4.1.1 of this chapter the following sections of trail are recommended to be narrowed. These locations are presented in Map 4.1. highlighted in blue.

Mayapple Hill (outer loop-adjacent to Northfield Village)

- Trail rarely used
- No areas of interest and no connections to other trails. Current trail ends at the Mayapple Loop Road, with no continuation on other side of road.
- Adjacent residential development will further degrade trail experience
- Northern portion of trail should remain as it can serve as connection between new developments and SMR
- Also consider removing trail completely, south of potential connection to Northfield Village.

Hillspur Trail

- Historically important so trail should not be realigned or removed
- Majority of classified as major improvements and is affected by severe erosion

Ravine Trail

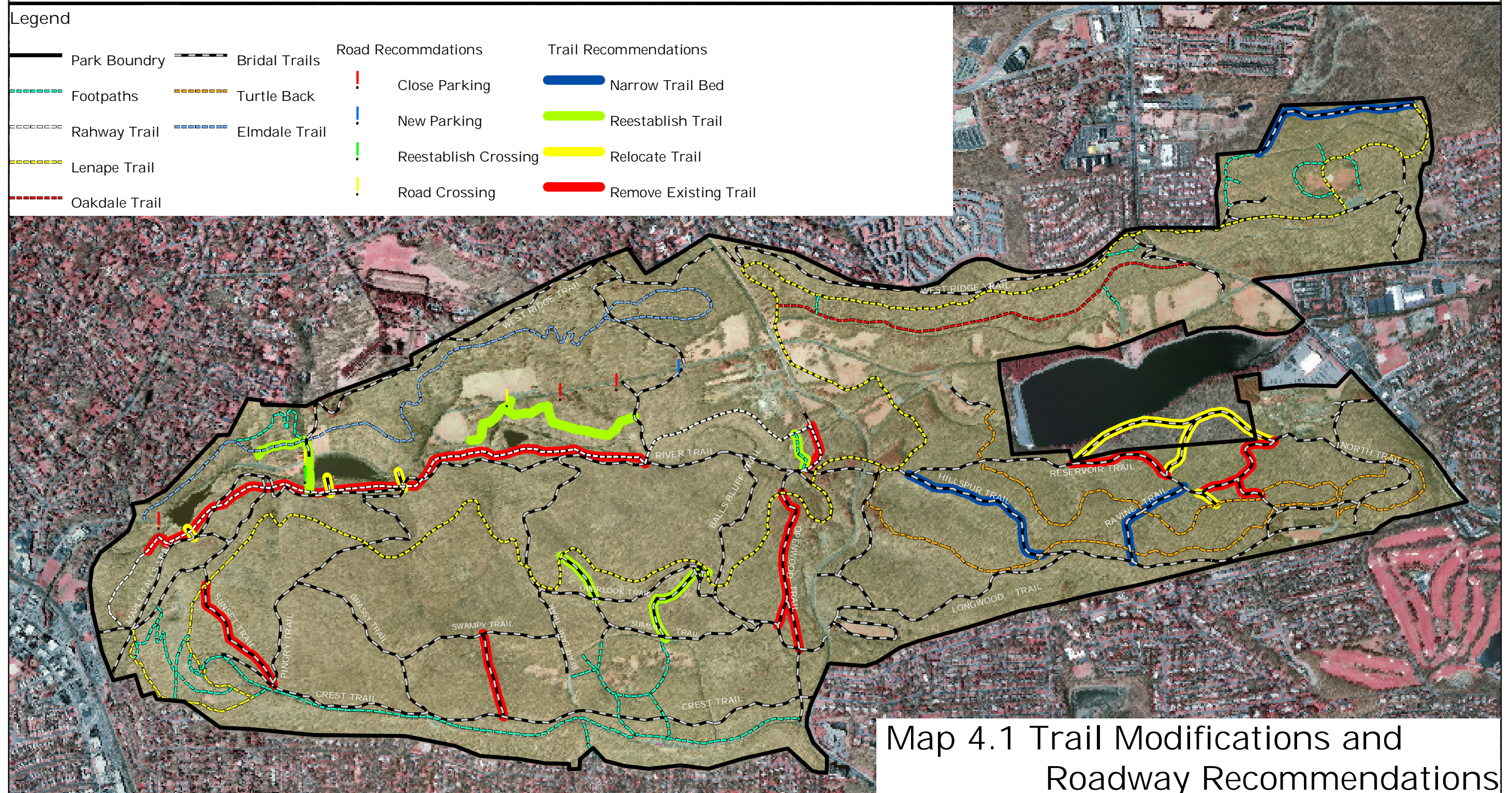
- narrow entire length of trail
- extend along historical route if Reservoir trail is relocated

SOUTH MOUNTAIN RESERVATION

LANDSCAPE AND INFRASTRUCTURE ASSESSMENT AND RESTORATION MANAGEMENT PLAN

Legend

Park Boundry	Bridal Trails	Road Recommendations	Trail Recommendations
Footpaths	Turtle Back	Close Parking	Narrow Trail Bed
Rahway Trail	Elmdale Trail	New Parking	Reestablish Trail
Lenape Trail		Reestablish Crossing	Relocate Trail
Oakdale Trail		Road Crossing	Remove Existing Trail



Map 4.1 Trail Modifications and Roadway Recommendations

INFORMATION SOURCES: NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF GEOGRAPHIC INFORMATION SYSTEMS

<http://www.nj.gov/dep/gis/index.html>
 NEW JERSEY IMAGE WHAREHOUSE
http://njig.nj.gov/OIT_IW/index.jsp



4.1.5 Trail Modifications – Reestablish trail

Based upon the evaluation of the above criteria in section 4.1.1 of this chapter the following sections of trail are recommended to be reestablished. These locations are presented in Map 4.1.1 highlighted in green.

Summit Trail to Mines Point and Ball's Bluff

- These areas have historically important views (see Map 3.15). They were one of the first areas opened up to the public as the improvements were occurring in the Reservation.
- The trails exist today and with moderate modifications can be reestablished.
- There is no existing easily accessible trail to these views. The trails could be slightly modified for ease of access.
- The trails would provide a more direct route from Summit Field and Crest Drive areas.

4.2 Slope and Soils

The soil that comprises much of the reservation is highly erodable and is not suited for supporting trails. Many of the trails, particularly those that run perpendicular to the slope have been built in a cut situation with the trail bed lower than the adjacent land on both sides. This makes these trails an ideal conduit for storm water to flow acting as a large drainage course for water from upper overland flow. This water tends to flow down trails that often follow the very steep slopes over the erodable soil. Measures such as swales along the side of the trail and numerous pipe crossings have been installed to help control this flow. However, in many areas these measures are nonfunctional. Sediment and debris have clogged many swales and pipes, forcing water to find a new path, often along the trails. As flows have increased due to loss of understory growth and increased erosion, many pipes and culverts are now undersized and unable to handle the flow.

Soils and slope are part of natural geology of the Reservation and as such are impractical to change. However, there are measures that can be taken that help mitigate the impacts of these factors. It is important to develop measures that will slow down overland flow. An important step is the reestablishment of understory vegetation. Vegetation will help loosen compacted soils, slow overland flow and increase water infiltration. Other measures that can be implemented include the use of stone, placing fallen trees on the slope perpendicular to the flow and stepped pools. Not only will such measures slow down water, but will allow the build up of sediment that will in turn provide a medium for the growth of the understory plants in areas where erosion has removed soil and has exposed the bedrock.

4.3 Wetlands and Infiltration Basins

The Reservation is dotted with many pockets of forested wetlands. What is interesting to note is that many of these wetlands are located along ridgelines and upper slopes. These wetlands often have no apparent surface source of water feeding them. This means they are most likely the result of underground springs or they retain water from rain events.

These areas were evaluated for the possibility of using them to help control water run-off by either expanding existing wetlands or creating new ones in strategic locations. The concept is to use these areas to hold more water or hold water longer for increased infiltration thus decreasing run-off. The wetlands located near the ridgeline are currently functioning as holding areas for the site water drainage. With the proposed expansion of the wetlands there must be adequate water to support the expansion. Wetlands by nature are a very fragile ecosystem and any change could have a negative effect. Due to their location at the top of the watershed it is unclear where the additional water required to support the wetland would come from.

Wetlands are also located in many of the steep drainage courses extending down the first mountain. Due to the steepness of the topography the expansion of wetlands is not practical. Stepped basins, however, should be utilized to slow down the water and hold back the sediment. See the landscape section for further discussion of this opportunity. The expansion of existing wetlands is not recommended.

An opportunity exists to create a wetland by Hot Winter Spring at the intersection of Ball's Bluff Trail and Grassy Trail. Water from this spring flows down and crosses Ball's Bluff Trail, one of the trails classified with Major Improvements. A wetland could be created at the base of the knoll that would hold the water and slow its travel down the mountain. Further investigations must be undertaken to fully understand the depth to bedrock and water budget for this wetland prior to any wetland creation. The creation of new wetlands would also place NJDEP jurisdiction on this wetland and connecting water drainage.

4.4 Natural Drainage Courses

There are several aspects pertaining to water flow that need to be addressed to help control erosion such as slowing water flow within drainage courses, directing runoff from flowing on trails and improving points where water is to cross the trails. Because of the way some trails were constructed, water has tended to find its way to the trails instead of the natural watercourses. Within the drainage courses, a measure used to slow down water is the use of stepped pools. This involves installing stepped pools to hold back water as it moves down the channel.

4.5 Trail Network Management Tools and Use Criteria

When managing the trails there is not one specific combination of tools that can be applied unilaterally throughout the reservation. Each site is different due to the location of the bridle trail/wood road related to topography (how steep the trail is, location at the top or bottom of the mountain, etc.), drainage courses and site hydrology (natural springs). The trails are exhibiting varying degrees of degradation due to how the bridle trails/wood roads were constructed with almost all in a cut situation where the bridle trail bed is lower than the adjacent ground surface. This cut situation creates a large man-made drainage course down the mountain. It is not feasible to return the bridle trails to a natural condition allowing the water to flow across the bridle trail due to the excessive amounts of disturbance, material and capital expenditure that would be required. The trails must, therefore, be managed through a variety of tools to capture, redirect and allow passage of the storm water through the site.

There are several different tools that may be utilized for trail improvements. Each tool may be used individually or in combination with other tools dependent upon the specific site situation. Utilizing the tools in combination will be the most effective means to manage the trails.

In the design of all such constructed elements, every effort should be made to make these solutions reflect the historic setting and Olmsted plan for the Reservation. Constructed stone solutions should be made using rusticated boulders of stone native to the site wherever possible, set into the slopes in a natural manner. Design guidelines should be developed as an immediate task as noted in Section 1.0 of this chapter.

Cobble crossing where drainage currently crosses the trail.

Utilize this tool:

1. when the other trail management tools would not provide much benefit for redirecting the water,
2. further modification utilizing other trail management tools would disturb a large area without redirecting a significant amount of water,
3. the redirection of water would create the same situation just further down the trail.
4. when year round vehicular access along the trail for maintenance either by county or local water companies or for fire protection is not required.

Regrade trail to low spot with a cobble crossing.

Utilize this tool:

1. to the greatest extent possible. The swales and pipes have a tendency to fill in and get clogged over time. Allowing the water to naturally flow across the trail will keep it on its natural path down the slope.
2. in some places in conjunction with stone on the down slope side. Stone should be used to stabilize the down slope side of the crossing when on a steep slope generally greater than 15% or when the crossing has a more concentrated flow across the trail.

Enlarge swale adjacent to trail.

Utilize this tool:

1. along areas of deep cut where too much material would be required to regrade trail to a low point with a cobble crossing.
2. where there is a significant amount of debris build-up.
3. to direct storm water to a designated trail crossing either a pipe crossing, cobble crossing or box culvert.

Place stone within swale adjacent to trail.

Utilize this tool:

1. along steep trail sections where there is a significant amount of erosion occurring (or would occur) on the trail due to a high volume of water traversing the trail.

Replace broken pipe with same size pipe.

Utilize this tool:

1. when there is evidence of minor to moderate amounts of erosion occurring due to the water finding it's way down the trail instead of the swale into the pipe.
2. in conjunction with swale restoration.
3. when is not feasible to utilize a cobble crossing to allow the water to cross the trail either with or without regrading the trail.

Replace broken pipe with larger diameter pipe.

Utilize this tool:

1. when there is evidence of moderate to major amounts of erosion occurring due to the water finding it's way down the trail instead of the swale into the pipe and it is not feasible to utilize a cobble crossing to allow the water to cross the trail either with or without regrading the trail.
2. when a pipe is undersized to handle the volume of water passing through it.
3. when it is evident that the existing pipe size cannot handle the water volume.

Rebuild trail bed with crown

Utilize this tool:

1. along areas within deep cut,
2. in conjunction with swales
3. along with riprap when necessary.
4. with soil binder to finish trail

Rebuild trail bed with cross slope

Utilize this tool:

1. in areas of shallow cut where close to balanced cut and fill or by introducing minor amounts of fill would reestablish natural flow across the trail.
2. with soil binder to finish trail

Construct a water bar across the trail to direct the water across the trail

Utilize this tool:

1. in areas of moderate slope where there the down slope of the trail is not in a cut situation and the upside of the trail has an impediment for the water to continue in the swale such as the crossing of another trail.
2. preferably when the water can be directed towards a drainage course
3. with stone if down slope is steep to mitigate erosion.

Redesign and reconstruct existing bridge

Utilize this tool:

1. when the existing bridge is in need of structural repair or there is evidence that the water is bypassing the bridge headwalls,
2. when the water quantity has increased due to increased development pressures
3. when trail can not be regarded to a low spot with a cobble crossing due to the need to provide year-round vehicular access for maintenance either by county or local water companies or for fire protection
4. in conjunction with placing large rounded boulders within the streambed for a short distance prior to crossing under the bridge and longer after the bridge to dissipate the water energy. Do not utilize a cobble or concrete apron, erosion will occur at the end of the apron.

Replace pipe with a box culvert bridge with stone façade and walls.

Utilize this tool:

1. when the water quantity has increased due to increased development pressures
2. when trail can not be regraded to a low spot with a cobble crossing due to the need to provide year round access for maintenance either by county or local water companies or for fire protection
3. in conjunction with placing large rounded boulders within the streambed for a short distance prior to crossing under the bridge and longer after the bridge to dissipate the water energy. Do not utilize a cobble or concrete apron, erosion will occur at the end of the apron.

Replace pipe with elevated footbridge.

Utilize this tool:

1. when installing a pipe would cause too much disturbance to existing drainage course and surrounding area
2. when trail elevation is low and existing pipe has no cover.

Boardwalk in low-lying areas.

Utilize this tool:

1. when existing trail is in a low area passing through wetlands
2. where a boardwalk would minimize disturbance in lieu of raising grade and providing for water to continue to pass towards the river.

4.6 Additional Trail Network Improvements

Other trail improvements are recommended that will allow for better circulation in the reservation.

Reconstruct river crossing along east-west bridle trail/wood road just to the south of South Orange Avenue.

This will allow for ease of access of maintenance vehicles to the southern half of the reservation. Reestablish the Rahway Trail to continue from The River Trail to the west side of the river. Currently a series of footpaths are meandering through wetlands near the river on the east side. Remove invasive vegetation and replant with native vegetation within the wetland area. Re-open views of the wetlands. This should be an intermediate task.

Re-establish reinforced pedestrian trails from Summit Field to Mines Point and Ball's Bluff

The grades of these trails would provide easier access to two of the Reservation's historic viewpoints. These trails should be reestablished in conjunction with improvements of the overlook and vista management at these two viewpoints.

Restore trail and woodlands outside Turtle Back Zoo due to construction operations.

Construction operations for improvements to the Turtle Back Zoo over the last several years have disturbed the trail that runs along to the zoo fence and trails used as construction access. In addition, the woodlands were damaged with trees being knocked down, debris piles and construction materials left within the woodlands. The trails and woodlands need to be restored and rehabilitated with regarding of the trails and drainage swales, completion of drainage improvements and removal of construction materials and debris and revegetating the woodlands with plant material consistent with the Olmsted plans and native to New Jersey.

5.0 AQUATIC ECOLOGY

The West Branch of the Rahway River forms in West Orange, just north of the Reservation, flowing south towards the Rahway River. A number of tributaries form in the Reservation and flow into the West Branch. Therefore, a large part of the Reservation serves as the headwaters for the West Branch. The headwaters are a critical water source for the entire river, and because of their intimate connection to the surrounding landscape, deliver nutrients and organic material (such as fallen leaves) to downstream regions, sustaining aquatic life downstream. The streams within the Reservation, however, have a number of influences that have affected the aquatic habitat and water quality of the streams and the stability of the stream system, including the development of the adjacent land and increase in impervious surfaces, compaction of soils within the Reservation, decrease in understory vegetation, and development of the trail system throughout the Reservation.

Within the tributaries that flow through the Reservation, natural sediment delivery to the West Branch begins at the headwaters at the tops of steep slopes. Interconnected with wetlands and groundwater, these headwaters help regulate natural river flow. When human influences cause instabilities in these tributaries, the affects on the natural sediment transport processes can negatively impact the downstream water quality within the West Branch. Science supports protection of these headwaters and their riparian zones in as natural a state as possible. However, in some instances, human influences such as the manipulation of the natural topography or increased flows due to development can have significant effects on these small streams. In these cases, simple protection measures are not enough to address the degradation of water quality and aquatic habitat that the channel instabilities are causing, so restorative measures prove necessary. Because of their smaller sizes, these streams provide excellent restoration opportunities for local, community-based initiatives. However, as stream stability depends on multifaceted and intricate aspects of the stream channel, its riparian zone, and its overall watershed, a successful restoration design must employ a combination of applied sciences, engineering techniques, and best professional judgment.

The first step in developing a restoration design is to evaluate the existing stream channel for evidence of instabilities and determine the specific project goals. Each stream, along with its riparian zone and overall watershed, must be assessed individually, as suitable restoration measures will depend on factors such as type of instability, flow volumes, velocities, channel substrate, and existing topography. As man-made constraints are often determining factors in the selection of restoration measures, it is imperative that existing and future constraints and their affects are considered during the initial evaluation. An overall restoration approach that promotes stream stability and enhances aquatic and riparian habitat is then selected; oftentimes, the simple and least invasive approach is best. The plan can also include other corrective actions, such as upstream erosion control or reduction of impervious areas.

The next step is to perform technical studies to determine if the restoration design plan achieves the project goals. Examples include hydraulic and hydrologic analyses, sediment transport analyses, and habitat assessment of existing and proposed conditions. The final

restoration design is an iteration of integrating the results of these studies and site constraints, resulting in selection of specific restoration measures that meet the restoration goals.

Typical stream instabilities that require restoration measures include bank erosion, bed degradation/erosion, and degraded habitat. Restoration measures involve adjusting the dimension, pattern, and profile of the stream to provide for a more stable channel geometry, alignment/sinuosity, and slope. Restoration of the West Branch of the Rahway River will be limited due to the close proximity of trails to the River bank. The River needs erosion control along its banks and the River's tributary. All of the tributaries located in the Reservation should receive some type of restoration combination of the measures noted below.

Channel Bank Erosion Control Measures

- Installation of root wads and other instream structures.
- Recontouring of channel geometry.
- Bankfull bench establishment.
- Revegetation/live staking of channel banks.

Channel Bed Erosion Control Measures

- Installation of grade control structures such as cross vanes (rock or log) and step pools.
- Stream channel realignment.

Habitat Improvement Measures

- Removal of fish passage obstructions.
- Installation of fish passage structures.
- Installation of large woody debris for habitat creation.
- Control of channel bed and bank erosion.

As can be seen from the overlap of restoration measures within the three categories above, installation of one measure often addresses multiple stream instability issues. Therefore, a successful restoration plan considers the interconnection of these instabilities and addresses the stream system as a whole.

Due to constraints in the Reservation, such as obstruction of natural flow patterns due to trails or compacted soils, restoration plans will need to integrate the use of typical stream restoration measures with hard engineering structures such as riprap channels, culverts, and stone scour aprons. It is imperative that these structures be appropriately sized for flow volumes, velocities, and orientation to promote natural flow patterns. Incorrectly designed

structures can further channel instabilities, leading to exacerbated erosion issues that extend beyond the original problem area.

Cost for restoration of a typical area along a tributary has been provided. However, the cost of the actual restoration will depend on the fix determined for each individual site and the design of the fix.

5.1 Priority Management Tasks

The following maintenance activities were developed after consideration of the many uses of the Reservation and the adjacent areas to help stabilize the West Branch and its tributaries that flow into the West Branch, and improve the water quality within the River and the ponds, while sustaining the aesthetic qualities associated with the River.

Immediate Tasks (within 1 year)

1. Employ invasive species and pest controls in areas disturbed during general maintenance activities. Plant disturbed areas with native vegetation that is undesirable to deer.
2. Discontinue mowing around pond and river edges.
3. Investigate the feasibility of placing floating islands in ponds, close to edges, to increase shading, improve water quality, and enhance habitat for fish, (<http://www.floatingislandinternational.com/>).

Intermediate Tasks (within 5 years)

1. Stabilize the river banks where trail network lies close to the river.
2. Decommission or relocate those trails near the river that do not have historic significance and are not required for safety.
3. Remove invasive vegetation located along river banks and pond banks.
4. Install floating islands within ponds if found feasible in earlier phase.

Long Term Tasks (ongoing and within 10 years)

1. Continue to monitor invasive species along river and pond edges.

6.0 ROADWAYS

A large part of the design of South Mountain Reservation was dealing with the movement of vehicular traffic through the Reservation. Major roadways already cut through the reservation. The network of residential streets surrounding the reservation had already been established and continued to grow. The original plans called for modifying some of the existing roadways. Brookside Drive and Cherry Lane was to be discontinued as a north-south circulation route, with Brookside Drive realigned to the east and Cherry Lane discontinued altogether. New north-south circulation drives were planned along the western edge of the reservation. South Orange Avenue, a major east-west route, historically and currently bisects the reservation. Northfield Avenue, also running east and west, borders the northern end of the reservation, and also separated the Mayapple Hill area from the remainder of the reservation. These two roads were to remain in their original alignment.

The intent of the original design was for much of the reservation to be accessible by a network of pleasure drives. These were vehicular roadways that meandered throughout the reservation and brought visitors to points of interest. These drives took advantage of the views and vistas that were established by the forestry management the Olmsted's implemented. The original plans showed that although the reservation south of South Orange Avenue was largely divided by the Rahway River, a crossing at Thistle Mill Ford provided an important connection east and west. And although this was the only physical connection circulation wise, the absence of a major thru-road allowed for the feeling that both sides of the river were one entity.

As the reservation developed, the emphasis on forestry management resulted in money not being available to develop the circulation as intended. Brookside Drive and Cherry Lane were never re-aligned and discontinued respectively. New roads were not constructed to the periphery as proposed. As a result, these roads form a sharp divide between the lands to the east and west. There is virtually no connection between these lands now.

It is apparent that non-approved vehicles are entering the reservation. Measures should be taken to discourage access by blocking with gates, fences and boulders.

Recommendations

- Clear Elmdale Trail from the Elmdale Parking area to Hawk Hill. This will provide access to Bass Pond (Campbell's Pond) at the dam from an established parking area. Develop a roadway crossing across Brookside Drive.
- Develop Hawk Hill gravel area as a trailhead. This will provide access to Bass Pond at the dam for crossing of Brookside Drive where there is good site distance. Develop a roadway crossing across Brookside Drive.
- Work jointly with City of Orange to have Campbell's Pond's dam and pedestrian access repaired. This would provide a critical connection across Brookside Drive connecting the

east and west sides of the Reservation. It would also provide a critical access from the west side of the West Branch of the Rahway River to the east side.

- Strategically place boulders along Brookside Drive to discourage parking next to the River. Replant disturbed areas.
- Convert gravel area at Diamond Mill Pond to a meadow. This is a historic opening.
- Develop trailhead parking area with 40 spaces just south of the maintenance facility on the east side of Brookside Drive. This is in an area historically classified as open. Close off the two small trailhead parking areas between this new parking and Dogwood Hillside. These are too small and perpetually wet due to their location near a wetland and drainage course. Remove gravel and replant disturbed areas.
- Develop a roadway crossing and formal connection from the Dogwood Hillside parking area to trails across Brookside Drive. Make the foot trail that follows the historic Oakdale Drive alignment a blazed trail that connects to an existing bridle trail/wood road. Continue newly blazed trail to Painters Point. Discontinue all other trails within this area by loosening soil and strategic planting of vegetation.

7.0 BUILDINGS AND STRUCTURES

Work on all buildings and structures should be in accordance with the Secretary of the Interior’s Standards. Design guidelines should be developed as an immediate task to provide direction for the rehabilitations and reconstruction improvements noted below. Further research should be completed to date the construction of those buildings and structures where it is not noted below and to create accurate detailed sketches with dimensions. This is important so their historic importance can be considered in the context of their rehabilitation. Prior to beginning any design or construction on the Reservation buildings and structures the original condition should be keyed to historic fabric through primary and secondary sources of photographs, correspondence, plans, etc. and field documentation of measurements, materials and condition. The bracketed numbers in the following text refers to the location of the building and structures noted on Map 3.17.

7.1 Buildings

7.1.1 Concession Stands

There are two buildings that appear to have been concession stands. One is in the Oakdale Picnic Area [7] and the other at the south end of Valley View Drive by South Orange Avenue [10]. They have been both abandoned. See the Oakdale Picnic Area description in Chapter 3 for more details on these buildings.



Figure 80 ~ Abandoned building at the Oakdale picnic area.

Recommendations

The one in the Oakdale Picnic Area should be restored and reopened as a concession stand. This is a good opportunity for the county to generate revenue off of concession sales. The building will need new electric and water service, both already existing nearby. Additional picnic tables should be located near the concession stand.



Figure 81 ~ Unused concession stand off of Valley View Drive..

The one at the end of Valley View Drive should be maintained as a cultural artifact. Further investigation should be done for the adaptive reuse of this structure as an overlook or shelter. This location would provide good views of the First Mountain and a good resting spot for those utilizing Valley View Drive as a pedestrian trail.

7.1.2 Restrooms

Out of the eight picnic areas three have functioning restroom building facilities, two have non-functioning restroom building facilities and are serviced by portable toilets and three do not have any restroom facilities. Although the facilities at Mayapple Hill [2], Summit Field [37] and Turtle Back Picnic Areas [21] would be considered functioning, repairs to the plumbing and buildings are required.

Demolition and reconstruction of the facilities at Oakdale [7] and Tulip Springs [14] Picnic Areas, currently serviced by portable toilets, were proposed in 1987 but were never completed. As a part of the same project three additional restroom buildings were proposed one at each of the following, Dogwood Hillside, Locust Grove Picnic Area, and Shady Nook Picnic Area. It is unclear why the proposed restroom upgrades and new buildings never occurred. Additional portable toilet facilities are currently provided at Painters Point and at Shady Nook Picnic Area.



Figure 82 ~ Tulip Springs picnic area restroom building with portable toilets .

Recommendations

There still exists a need today for restroom facilities at the current locations with restroom buildings. These buildings should be renovated or demolished and reconstructed as planned in 1987. A new restroom facility at Shady Nook Picnic Area should also be constructed as planned in 1987. It is not appropriate, however, for a restroom facility to be located at Dogwood Hillside. All facades should be constructed with stone finish consistent with the historic plans.

7.1.3 Maintenance Building

The maintenance building [24] is adequately screened from the adjacent roadways and from within the reservation. Regular maintenance is recommended. A new facility for the K-9 Police Unit is under construction. This facility should be screened from South Orange Avenue with vegetation and in a design in keeping with the Olmsted Plans and plant list. Olmsted plans 45, 68 and correspondence should be consulted to design and implement the screen.

7.2 Structures

There are several different types of structures within South Mountain Reservation. These structures include picnic shelters, overlooks, bridges, dams, and benches, bar-BQ grills and fireplaces what we term today site furnishings.

7.2.1 Picnic Shelters

There are eight shelters in five picnic areas in the reservation, one shelter at Locust Grove Picnic Area [40], two shelters at Mayapple Hill Picnic Area, three shelters at Summit Field Picnic Area, two shelters at Tulip Springs Picnic Area [13, 15], and one shelter at Turtle Back Rock Picnic Area [22]. Two of the three shelters at Summit field and the two shelters at Mayapple Hill are the historic design except they are missing the benches. The original shelters at Summit Field were constructed by the CCC NJ SP #13 in 1938 as noted in the 1939 ECPC annual report.

The other five shelters are of varying style and condition with no consistent design between them. One shelter at Summit Field has maintained the massing of the original design keeping the character of the historic design, but does not use the log columns of the original design. See the specific picnic area descriptions for more detail on each structure.

The remaining historic shelters should be repaired including replacement of benches. Entrances to the shelters should be made ADA accessible by regrading and the use of stabilized dense graded aggregate. The interior floors of the shelters should be brought up flush with the shelter sill and should be reconstructed in a manner appropriate to the historic shelter. Reconstruct historic seats around the edge of the shelters. Mayapple Hill had portable picnic tables. Provide picnic table seating within shelters.

The other shelters should be repaired as necessary and maintained for their life expectancy. Upon replacement the shelters should be rebuilt utilizing the historic design including round log columns. They should be located in the historic location with repairs to the foundations as necessary.

The picnic shelter located off the West Ridge Trail should be rebuilt with a connecting trail in the historic design.

There are remnants of what appears to have been a shelter located at Peak Hill Point [9] east of the West Ridge Trail in the northern section of the reservation. A footing remains for a round log similar to those found near bridges in other locations of the reservation. There are also four concrete footings with steel columns cut near grade. A shelter is not historically noted on the Olmsted plans but there is a view noted from this point. The footing remains for a round log indicate that there was some historic structure at this location. Other shelters had been replaced with steel column shelters and it is probable that this one was also.

The structure remnants should be further investigated to determine their historic significance. If they are historic they should be retained as cultural artifacts. They should be incorporated into an overlook structure. The view over West and East Fields to the first mountain should be reopened.

Rustic shelters were constructed at Washington Rock, Ball's Bluff and Hemlock Falls to accommodate the growing number of visitors as noted in the 1908 Essex County Park Commission Annual Report. They were constructed of chestnut logs with bark left on and were intended to be unobtrusive resting places.

7.2.2 Diamond Mill Dam

The work on the Diamond Mill Dam was Civilian Conservation Corp (CCC) Camp No. 2 project 122 with work nearing completion in 1936 (ECPC annual report 1938). The dam was to be rebuilt using as much of the existing stone infill where possible. The dam currently needs minor repair to correct the water seepage through the face as well as to stabilize the toe of the dam. All work should be in keeping with the historic character. It will also require NJDEP approval and possibly approval by the State Historic Preservation Office.

Historically the Olmsted firm planned to have Maple Falls Drive cross the river from Brookside Drive just below the dam. Then in 1939 there was a CCC Camp No. 2 project No. 301 for a footbridge just below the dam. It is recommended that this pedestrian connection is not reintroduced. There is no safe place for pedestrians to traverse across Brookside Drive / Glen Avenue intersection.

7.2.3 Foot Trail and Bridle Trail Bridges

There are numerous drainage crossings that are footbridges and some bridle trail bridges capable of carrying vehicles, many of which are in keeping with the historic design character even if they are not the historic structures. The footbridges typically have a 6'-wide trail bed. The vehicular bridges typically have a 12'-wide trail bed. Vehicular access is required through the reservation for maintenance of the reservation and water main that traverses the reservation as well as for fighting fires.

Recommendations

All work on bridges should be in keeping with the historic character with the modification of stone parapet walls in lieu of log handrails. Mortared cobble or concrete flow channels under bridges should not be used as erosion occurs at the end of the reinforcement unless it is an unreasonable length. Work on bridges will require NJDEP approval if they are located within wetland areas and may require NJDEP approval elsewhere. Bridge work may also require State Historic Preservation Office approval.

Hemlock Falls Foot Bridges

The Hemlock Falls area was a highly utilized area historically and remains so today. It was identified on the Olmsted plans and in correspondence as an important destination and was originally intended to be access from the east along “artistically arranged paths and winding steps that lead to the sequestered valley below.” (AR 1930, p.10) In addition, Civilian Conservation Corps State Park Camp No. 2 completed work on the two original bridges at Hemlock Falls around 1935. Concrete and stone footbridge was constructed in 1954 noted in the 1955 annual report. There are also footing remnants of the log railing that extended past the bridges. The log handrails over the bridges have been replaced with masonry parapet walls in keeping with the character of the masonry support walls.

There is significant erosion occurring undercutting the bridge masonry support walls as well as the surrounding bank. These structures need stabilization in the short term. In the long term a study should be completed to determine the volume and velocity of water that traverses through the bridges from Hemlock Brook and surrounding residential area and Hobble Brook.

Hemlock Brook starts out of the reservation in South Orange. At the time the reservation was being developed the ground cover of the drainage area in South Orange was forest. The land cover now is residential housing with associated streets. This has increased the runoff that passes through the reservation. Hemlock Brook crosses under the bridge closest to Hemlock Falls and merges with Hobble Brook just before the second bridge.

Hobble Brook begins across South Orange Avenue north of the intersection of Hillspur Trail and Longwood Trail. Prior to reaching the second bridge west of Hemlock Falls it is intended to cross the Hemlock Falls Trail in a 30” RCP culvert. This culvert is not adequate for the volume due to the sedimentation occurring upstream and/or the culvert is not adequately sized for the volume of water. There is erosion occurring where the water bypasses the culvert and travels over the trail, exposing the culvert.

Recommendations

The study noted above should be used to evaluate whether the pipe is adequate and maintenance of the drainage way is all that is required or a larger structure should be constructed. If the pipe is to be utilized then masonry stone headwalls should be constructed similar to those in other locations in the reservation. Stone shall be placed on the down stream side to help stabilize the soil and prevent erosion. The size, color and shape of the stone are to compliment the historic and natural character of the Reservation.

If the volume and velocity exceeds current capacity the bridges should be redesigned keeping in character to the historic designs to meet current storm water management needs.

River Trail Vehicular Bridge (just south of Hemlock Falls Trail)

The drainage from Hemlock Falls and Hobble Brook continues west to the river adjacent to Hemlock Falls Trail and crosses the River Trail just south of Hemlock Falls Trail under a vehicular bridge. The timber bridge was replaced with the stone and concrete bridge in 1947 as noted in the 1948 ECPC annual report.

There is more erosion occurring at this bridge than the two bridges upstream with evidence that the water is crossing the River Trail and bypassing the bridge. Erosion has also undermined the guard wall on the south west side and it is collapsing into the brook.

Recommendations

Immediate stabilization is required. In the short term the storm water study for the drainage area upstream should be continued downstream for this bridge. In the long term the bridge should be reconstructed to handle the current storm water that flows under this crossing.

Tulip Springs Picnic Area Foot Bridge

This bridge does not even remotely keep with the character of the historic bridges. It has an exposed concrete deck with pipe handrails. This bridge was noted as constructed in 1952 in the ECPC annual report published the following year. There are stone support walls that could be of a historic design. There was no reference to this bridge in either the plans, correspondence or annual reports that were reviewed. The bridge provides an important connection through Shady Nook Picnic Area to the reservation west of Cherry Drive. The Lenape Trail is also routed across this bridge.



Figure 83 ~ Foot bridge at replaced from the original set on the abutments

Recommendations

This bridge should be replaced with a bridge similar to those found at Hemlock Falls. The riverbanks at the support walls should be reinforced with native plantings.

Maple Falls Foot Bridge

The 1954 ECPC annual report noted the footbridge was replaced with a stone masonry bridge. Drainage calculations should be completed to see if the opening is adequate. The adjacent slopes should be stabilized with large rustic boulders and landscaping consistent with the Olmsted plans.

Maple Falls Vehicular Bridge

The 1954 ECPC annual report noted the old bridge across the falls was removed and replaced with a stone culvert. Drainage calculations should be completed to see if the opening is adequate. The adjacent slopes should be stabilized with large rustic boulders and landscaping consistent with the Olmsted plans.

Thistle Mills Ford Foot Bridge

The CCC constructed a pedestrian crossing at Thistle Mills Ford in 1935 from native oak logs. It was demolished in 1946 due to unsafe conditions as noted in the 1947 Essex County Park Commission annual report. Existing stone steps lead from Brookside Drive down to the river. This area remains a picturesque site. While pedestrian access to this area is desirable it is unsafe for pedestrians to cross Brookside Drive from the gravel area to the west due to poor site distances both north and south.

Recommendations

The bridge should not be reconstructed. Pedestrian access should continue from Painters Point. The stone steps should remain as cultural artifacts.

Vehicular Bridge Across River south of Ravine Point

This bridge crosses the West Branch of the Rahway River at south of Ravine Point connecting the River Trail to a bridle trail that leads to a parking area on Brookside Drive north of Dogwood Hillside. The wooden bridge was replaced in 1951 with the concrete and stone bridge there today set on the old masonry abutments. The existing bridge is in good condition. Erosion is occurring at the downstream side of the cobble crossing underneath the bridge and along the abutments from pedestrian traffic.

Recommendations

Routine maintenance is required. The abutments should be planted with native vegetation according to Olmsted design principles.

Campbell's Pond Foot Bridge

There are 1935 CCC plans noting a bridge crossing the West Branch of the Rahway River south of Campbell's Pond Dam. A river crossing at this point would provide a connection from the Elmdale Trail to the west, to the Rahway Trail and current Maple Falls Trail to the east as well as provide a pedestrian connection from the south. There currently is an underutilized parking area that would serve as a trailhead for access to the reservation on both sides of the river.

Recommendations

A study should be completed that would model the storm events and the size of crossing that would be needed to determine if it is feasible.

Ridge Field (Girl Scout Camp) Vehicular Bridge

Two of the Girl Scout Camp cabins are located to the east of Hemlock Brook. There is a concrete and stone bridge whose parapet walls have entirely collapsed. Chain link fence is used to secure the bridge from the drop to the brook elevation. There is also erosion above and at the ends of the support walls.

Recommendations

Complete drainage study for this structure at same time as the study conducted for the other bridges along this brook. Rebuild bridge to meet the storm water requirements reflecting the current built state of the watershed.

Various small bridge crossings

Located along the bridle trails are numerous culverts with stone headwalls, some with parapet walls. The WPA constructed stone parapet head walls with concrete pipe culverts to replace wooden bridges in and around 1940 (AP 1940). These crossings are in various conditions ranging from good to poor needing replacement.

Recommendations

Replace bridge on the River Trail north of the Pingry Trail. Reconstruct parapet walls on the two crossings near the above noted bridge. Provide regular maintenance of tuck pointing and clearing of debris from the drainage course.

7.2.4 Equestrian/Pedestrian bridges

These crossings over main county thoroughfare roads do not match the concrete and stone footbridge design vocabulary. They are constructed out of steel and concrete with chain link fence with screen atop parapet walls.

Northfield Avenue Bridge

This bridge was finished in 1939 by county highway department.

Recommendation

Replace chain link fence with ornamental fence with some other appropriate material consistent with the historic character of the park to screen the roadway below. Provide continued maintenance.

South Orange Avenue Bridge

Recommendation

Replace chain link fence with ornamental fence with some other appropriate material consistent with the historic character of the park to screen the roadway below. Provide continued maintenance.

7.2.5 Deer Paddock

The deer paddock [33] currently has a 10' height fence enclosing a 25-acre area sectioned off into quarters with a central holding area. There exists a small pole barn with storage area. The county is currently in the process of reusing 3 acres of this area as a dog park. Improvements will occur in the exiting open area and will not encroach within the wetland area. The existing pole barn may be reutilized as a shelter for the dog park.

Recommendations

Renovations to the pole barn, if reused, should include modifications to bring the character in keeping with the historic rustic nature of the park by utilizing stone masonry and massing in keeping with the oak and chestnut logs used for the shelters and bridges. Other improvements should also reflect the historic rustic nature. The improvements should blend into the surroundings, should be unobtrusive and should not act as a focal point.



Figure 84 ~ Wetlands within deer paddock area.

The dog park should be located out of the wetlands and a 50-foot buffer should be provided. Wetlands located in the deer paddock are headwaters for both Beach Brook and Maple Brook that drain into the West Branch of the Rahway River. The wetlands, in conjunction with a vegetated buffer, can act to filter the nonpoint pollution possible from the dog park. The natural system's capacity to filter pollution is not unlimited so the number of dogs in the dog park at one time needs to be set with this in mind. Enforcing picking up dog waste is also important to not overload the natural system.

A 1993 EPA report (*Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters*, EPA-840-B-93-001c) cites that:

"Pet droppings have been found to be important contributors of NPS pollution in estuaries and bays where there are high populations of dogs. Fecal coliform and fecal streptococcal bacteria levels in runoff in several drainage basins in Long Island, New York, can be attributed to the dog population (Long Island Regional Planning Board, 1982). ...Eliminating or significantly reducing the quantity of pet droppings washed into storm drains and hence into surface waters can improve the quality of urban runoff. It has been estimated that for a small bay watershed (up to 20 square miles), 2 to 3 days of droppings from a population of 100 dogs contribute enough bacteria, nitrogen, and phosphorus to temporarily close a bay to swimming and shellfishing."

Dr. Mansour Samadpour, a molecular biologist with the University of Washington and the nation's leading pioneer on the use of genetic testing to trace bacteria contamination in streams to host animals, believes that unscooped dog waste is an extremely significant source of E. coli contamination in urban streams in the United States.

The use of Best Management Practices's such as those listed below will help improve water quality

- Providing a vegetated buffer between the dog park and drainage areas;
- Adding pooper scooper stations with free sanitary "pick-up" bags and proper receptacles as noted in the RFP;
- Incorporating public outreach elements like signage and informational brochures into and around the dog park.

South Mountain Reservation is home to a number of types of wildlife that are not compatible with dogs that have been observed in the area of the set aside for the dog park. These include deer, raccoon, skunk, porcupine and wild turkey. There is an existing perimeter fence that can be utilized to keep the native wildlife out. The large gates, however, will need to be closed. There are two gates, one on the east and one on the west that are currently open and need to be closed.

7.2.6 Overlooks (View Points)

There are 29 historic view points within the reservation as noted by the Olmsted firm on their 1902 and 1909 plans. The following is a discussion of the major views. See Map 3.15 Historic Vistas for the location and names of these 29 vistas. We gave the view points names based upon the landscape feature place name on the noted maps. Also refer to Table 8 at the end of this section which lists the view points, contribution, condition and ease of rehabilitation and a general list of work to be completed for each view point.

Washington Rock



Figure 85 ~ View to the south from Washington Rock Overlook.

It is local lore that General George Washington stood at this point to survey the valley for oncoming militia. This along with the striking view gave the Essex County Park Commission purpose to extensively develop this site and drive leading to this site. The stone retaining wall along East Ridge Drive (Crest Drive) was built to allow vehicular access to this site.

This site historically had a covered shelter where people came to view the valley below as they do today. Although with lack of seating or shade the overlook is not heavily utilized. [39]

Recommendations

The overlook shelter should be reconstructed based upon historic plans and photographs. A program of vegetation management should be developed to maintain desired vistas. Existing trees should be selectively pruned to enframe some views and to screen unwanted views. Annual maintenance should be managed according to clear guidelines and arboricultural practices. Removal of invasive species and replanting should be carried out according to the Olmsted planning and good practice procedures. Replanting the forest floor with appropriate vegetation to cover the exposed soil should be planned to reduce erosion, texture the ground plane and allow for the above-mentioned vista management. Add identification and waypoint signage. Remove or convert paved area to the north of the overlook to a new use such as a picnic area as vehicular access is not anticipated to be reopened to this area.

Bramhall Terrace



Figure 86 ~ View of Bramhall Terrace from Summit Field.

To celebrate the spectacular views along the East Ridge Drive (Crest Drive), another overlook was constructed as a memorial to long-term Commission member George Bramhall with a plaque provided by his children. The rustic stone wall of the overlook, the memorial boulder and the benches were designed by the Olmsted firm and set an aesthetic standard for this type of construction for the Reservation.

Recommendations

A program of vegetation management should be developed to maintain desired vistas. Existing trees should be selectively pruned to enframe some views and to screen unwanted views. Annual maintenance should be managed according to clear guidelines and arboricultural practices. Removal of invasive species and replanting should be carried out according to the Olmsted planning and good practice procedures. Replanting the forest floor with appropriate vegetation to cover the exposed soil should be planned to reduce erosion, texture the ground plane and allow for the above-mentioned vista management. Shrubs should be planted to enhance the area in keeping with the Olmsted plant palate.

Overlook Point (Ball's Bluff)

Access to this point was one of the first interior destinations provided to the public. It was part of a loop trail from Bramhall Terrace to Overlook Point to Mines Point and back to Bramhall Terrace. This location afforded a good view of the valley with the west side of the First Mountain, Orange Reservoir and Second Mountain in the distance. Remnants from the structure at this location exist today.

Recommendations

Intermediate task is to reconstruct the overlook with trailside benches. This would act as a resting spot for travelers along the Lenape Trail, Balls Bluff Trail and Overlook Trail. A long-

term task is to reopen this view providing a varied experience viewing the northern Reservation valley. The vegetation should be managed to maintain the views with selective thinning and annual trimming of the tree canopies. Invasive vegetation should be removed and the forest floor should be replanted with native vegetation at a density where the vegetation covers all of the exposed soil.

The Craig

An unnamed viewpoint was noted on the Olmsted 1909 plan along Westridge Drive just to the north of the area noted on the plan as The Craig [6]. The overlook was built, however, at the location called The Craig. The overlook is in very good condition. The historic view was a rare view of the First Mountain over North Field and Orange Reservoir. Due to the steep topography and nature of the forest at this location it would be relatively easy to reopen the view.

Recommendations

Short term task to reopen the view. It provides an opportunity to provide an improvement in the western portion of the reservation and reintroduces a destination that is relatively easy to access. The vegetation should be managed to maintain the views with selective thinning and annual trimming of the tree canopies. Invasive vegetation should be removed and the forest floor should be replanted with native vegetation at a density where the vegetation covers all of the exposed soil.



Figure 87 ~ The overlook structure at The Craig.

Painters' Point

In the 1922 annual report Koehler noted the following about Painters Point: "The effect is that of a vast solitude, a pleasant loneliness...No other locality on the Reservation that I have discovered affords a view of this kind. I was wondering if it should not be preserved." This view in conjunction with improving the picnic area and access to the Rahway Trail provided at Painters Point would provide a good destination area within the Reservation.

Recommendations

Tasks to be done within one year include adding identification signage at Brookside Drive and researching the possibility of removing dam with weir. This would help decrease the buildup of sediment and the increased bank erosion in this area.

Intermediate task include: stabilizing the slope of the trail leading to the view and the slope at the terminus, removal of invasive vegetation within the view shed and replanting with native

vegetation. Stabilization of slope should include measures to discourage access to the river from this point. Access is provided at another location within Painters Point. Parking limits need to be defined and limited so the ability to dump debris is removed. Bar-b-q grills should be repaired or replaced with historic campfire grills.

Long-term task would be to expand the trail terminus to an overlook with a northern view. The picnic tables should also be replaced with historically correct 12 ft. stone base tables.

Crest Drive Overlook

The area consists of a flat gravel area with a view to the east. The area used to be utilized for parking. With the management decision to not allow cars past Summit Field Picnic area parking is no longer required. Redeveloping the area as an overlook with benches and other

amenities would provide a good rest spot along East Ridge Drive (Crest Drive) about half way from the parking area to Washington Rock.

Recommendations

Construct railing or wall near edge, remove current posts. Remove wheel stops. Add benches along edge for viewing. Clear trees and brush to open up views. Add pedestrian paths from Crest Drive. Remove existing pavement, replant with native vegetation.

View Point No.	View Point Name	Remaining Historic Fabric	Contribution	Condition	Ease of Rehabilitation	General Description of Work
			Major Intermediate Minor	Good Fair Poor	Difficult Moderately Difficult Very Difficult	
1	Washington Rock Overlook	Yes	Major	Fair	Difficult	Selective clearing/recreate historic overlook structure/new plantings
2	East Ridge Drive (Crest Drive)	Yes	Major	Fair	Difficult	New overlook structure/extensive new plantings
3	Bramhall Terrace (Crest Drive)	Yes	Major	Fair	Difficult	Selective clearing/ new plantings/moderate hardscape
4	Overlook Point (Ball's Bluff)	Yes	Major	Poor	Very Difficult	Extensive selective clearing/extensive new plantings/recreation of historic overlook
5	Overbrook Point (North)	No	Intermediate	Poor	Very Difficult	Extensive selective clearing/extensive new plantings
6	Overbrook Point (South)	No	Intermediate	Poor	Very Difficult	Extensive selective clearing/extensive new plantings
7	Painters Point	Yes	Major	Poor	Very Difficult	Selective clearing/extensive new plantings/ new overlook
8	Bend Point	No	Intermediate	Poor	Moderately Difficult	Extensive selective clearing/extensive new plantings
9	Tumble Hill (Valley View Drive)	No	Intermediate	Poor	Very Difficult	Extensive selective clearing/extensive new plantings
10	Hillspur Drive (East of Hillspur Trail)	No	Intermediate	Poor	Very Difficult	Extensive selective clearing/extensive new plantings
11	Peak Hill Point	No	Major	Poor	Moderately Difficult	Extensive selective clearing/extensive new plantings/recreation of historic shelter
12	The Craig	Yes	Major	Fair	Moderately Difficult	Extensive selective clearing/extensive new plantings
13	Westover Point (Never Developed)	No	Minor	Poor	Very Difficult	Do not recommend opening view as is would be of new residential development not the view envisioned by the Olmsted firm.
14	Maple Falls (Lenape Trail)	No	Intermediate	Poor	Moderately Difficult	Extensive selective clearing/extensive new plantings
15	Maple Falls (Lenape Trail)	No	Intermediate	Poor	Moderately Difficult	Extensive selective clearing/extensive new plantings
16	Mines Point (Towards Campbell's Pond)	No	Intermediate	Poor	Very Difficult	Extensive selective clearing/extensive new plantings
17	Mines Point (Towards Hawk Hill)	No	Intermediate	Poor	Very Difficult	Extensive selective clearing/extensive new plantings
18	Overbrook Drive (Brookside Dr. North)	Yes	Minor	Fair	Moderately Difficult	Moderate selective clearing/moderate new plantings
19	Hawk Hill Point	No	Intermediate	Poor	Moderately Difficult	Moderate selective clearing/moderate new plantings
20	Bow Point	No	Major	Poor	Moderately Difficult	Moderate selective clearing/moderate new plantings
21	Falls Grove	No	Intermediate	Poor	Moderately Difficult	Extensive selective clearing/extensive new plantings
22	Valley View Drive (Elmdale Trail)	No	Minor	Poor	Moderately Difficult	Selective clearing/new plantings/moderate new hardscape to the view point
23	Valley View Drive (Elmdale Trail)	No	Minor	Poor	Moderately Difficult	Selective clearing/new plantings/moderate new hardscape to the view point
24	Valley View Drive (View Over Westfield)	No	Intermediate	Poor	Moderately Difficult	Moderate selective clearing/moderate new plantings/moderate new hardscape to the view point
25	Valley View Drive (View Over Westfield)	No	Intermediate	Poor	Moderately Difficult	Extensive selective clearing/extensive new plantings/moderate new hardscape to the view point
26	Valley View Drive (View Over Westfield)	No	Major	Fair	Moderately Difficult	Moderate selective clearing/moderate new plantings/moderate new hardscape to the view point
27	Valley View Drive (View Over Westfield)	No	Major	Fair	Moderately Difficult	Extensive selective clearing/extensive new plantings/moderate new hardscape to the view point
28	Grove Point (Turtle Back Trail)	No	Minor	Poor	Moderately Difficult	Extensive selective clearing/extensive new plantings
29	Grove Point (Turtle Back Trail)	No	Minor	Poor	Moderately Difficult	Extensive selective clearing/extensive new plantings

Table 7 ~ View Point Assessment

7.2.7 Girl Scout Cabins and out houses

Ten cabins are located surrounding the historic Ridge Field. The cabins are of various sizes. It appears the original cabins have had additions constructed. Two of the cabins area located to the east of Hemlock Brook. [23]

Recommendations

Regular maintenance of the cabins should be provided. The outhouses should be retained and maintained, as they are part of the historic use.

7.2.8 Boy Scout Cabin and out house

A single wooden cabin and a small wooden outhouse [18]are located in the Boy Scout camp area. Portable toilets were present in the summer indicating the outhouse is not utilized.

Recommendations

Regular maintenance of the cabin is recommended. Repair cabin as necessary. The outhouse should be retained and maintained, as it is part of the historic use. Consider replacing with building more in keeping with character of Reservation.

7.2.9 Campfire grills

Campfire grills are found in many of the picnic areas. They are constructed of stone and have either a double or a quad arrangement.

Recommendations

Repair as necessary. As the bar-b-que grills need to be replaced replace with historic campfire grills.

7.2.10 BBQ grills

A common amenity of all picnic areas is barbeque grills. The grills are mounted on pedestals and are comprised of either a single or double grill. The majority of grills are rusted and there are numerous instances where the grill is missing and only the post remains.

Recommendations

For short-term improvements, the grills should be cleaned and the cooking surface replaced. The missing or damaged grills should be replaced. Long-term improvements should include a program of replacing all grills with the historic campfire grills.

7.2.11 Oakdale archery storage shed

A small storage shed [4]has been constructed adjacent to the archery field in the Oakdale area. The shed is a common style found in many residential yards. The building architecture does not match any other structure in the Reservation and does not respect the historic character of the reservation.

Recommendations

The building should be removed and replaced with a structure more in keeping with the historic architecture of the reservation.

7.2.12 Maintenance Area Structures

The maintenance building is in good condition and is adequately screened from Brookside Drive and South Orange Avenue. A small open-faced pole barn [26]is located to the south of the salt silo east of the entrance drive. It is constructed of CMU block and is in good condition. A salt silo [25] is located to the east just as the facility is entered. Wood chips are located behind the silo further to the east. Storm water drains behind the silo to wetlands located north of this area. Garbage is being pushed into the woods next to the wood chip stockpiles. The historic incinerator is located in the maintenance complex in the woods to the south of the log stockpile area. The structure is constructed of masonry, in good condition and is no longer used.

Recommendations

Storm water should be properly managed so gasoline, oil, grease, salt and other non-point pollution sources are not allowed to drain into the wetlands. The garbage should be properly disposed of or composted, not pushed into the woods. The garbage should be removed and the wooded area restored. The incinerator should be maintained as a cultural artifact. A new facility for the K-9 Police Unit is under construction. This facility should be screened from South Orange Avenue with vegetation and in a design in keeping with the Olmsted Plans and plant list. Olmsted plans 45, 68 and correspondence should be consulted to design and implement the screen.

8.0 GENERAL USE AREAS

Work within the general use areas should be in accordance with the Secretary of the Interior Standards. Design guidelines should be developed as an immediate task to provide direction for the rehabilitations and reconstruction improvements noted below. Further research should be completed to date the construction of those buildings and structures where it is not noted below. This is important so their historic importance can be considered in the context of their rehabilitation. Prior to beginning any design or construction on the facilities in the general use areas the original condition should be keyed to historic fabric through primary and secondary sources of photographs, correspondence, plans, etc. and field documentation of measurements, materials and condition. Immediate Tasks should be completed within one year. Intermediate tasks should be completed within five years and long term tasks should be completed within 10 years.

8.1 Locust Grove

Immediate Tasks

1. Install sign at entrance off Glen Avenue. Currently not marked
2. Stripe parking spaces.
3. Remove or replace footbridge on Rahway trail.
4. Add trash receptacles to picnic area
5. Clear out debris from shelter area.
6. Repair picnic tabletops as necessary.
7. Clear brush away from drinking fountain. Define the drinking fountain area so visitors know it is part of the area and usable. Consider relocating if possible.
8. Add informative or warning to sign to pipe used for collecting spring water if that's its intended use.

Intermediate Tasks

1. Add directional markers that could point towards picnic area or to trails.
2. Replace concrete block with a gate more in keeping with character of park
3. Restore barbeque grills
4. Add a surface treatment (stabilized crushed stone) to floor of shelter.
5. Repair shelter roof.

Long Term Tasks

1. Replace 8-foot tables with 12-foot stone base tables.
2. Replace brick picnic table supports with mortared stone.

8.2 NJ American Water Company Structure

Immediate Tasks

1. Discuss with responsible party replanting the top of the holding tanks with native meadow grasses.

8.3 Summit Field Picnic area

Immediate Tasks

1. Delineate parking spaces with striping.
2. Add ADA accessible spaces in main parking area, closest to picnic areas
3. Reposition trash receptacles (at trailhead leading to Grove C, on the left side of Bear Lane at end of parking area. Additional receptacles spread out evenly along parking lot
4. Repair all picnic tables as necessary.
5. Repair picnic shelters as necessary, including benches in Grove A
6. Maintain at least one ADA accessible route (stabilized path) to at least one picnic area

Intermediate Tasks

1. Add signage identifying areas and waypoints to picnic areas.
2. Remove or rebuild stairs in Grove A
3. Restore barbeque grills
4. Add floor surface for picnic shelters
5. Add directional signage
6. Provide trail cobble crossing in Grove C

8.4 Bramhall Terrace

Immediate Tasks

1. Replace benches with historic benches.
2. Delineate spaces with striping including Add ADA accessible parking spaces

Intermediate Tasks

1. Add lighting
2. Add signage



Figure 88 ~ Viewing area at Bramhall Terrace showing benches in need of replacement.

8.5 Elmdale Picnic Area

Immediate Tasks

1. Define limits of parking area.
2. Clear Elmdale Trail of vegetation from picnic area to Hawk Hill.
3. Provide pedestrian access to Elmdale Trail from the picnic area.
4. Add signage on Brookside Drive to identify area and Elmdale Trailhead marker.
5. Add trash receptacle to parking area and picnic area

Intermediate Tasks

1. Replace barbeque grills with historic campfire grills.
2. Add additional picnic tables.
3. Reestablish trail access from parking area to Hawk Hill.
4. Add trail marker and trail map to beginning of trail.
5. Control knotweed on Elmdale Trail from picnic area to Hawk Hill.

8.6 Hawk Hill

Immediate Tasks

1. Establish limits for parking including surface material.

Intermediate Tasks

1. Work with City of Orange to remove graffiti from well house buildings.
2. Redefine trail network from Elmdale trailhead sign.

Long Term Tasks

1. Work with City of Orange to remove abandoned well house.
2. Reestablish view.



Figure 89 ~ Hawk hill with the hint of the view possible once vegetation is selectively removed.

8.7 Dogwood Hillside/Bend Point

Immediate Tasks

1. Improve safety for ingress/egress to parking lot i.e. sight distance and width of entrances.
2. Add signage along Brookside Drive to identify area and mark entrance.
3. Fill in low spots in parking lot

Intermediate Tasks

1. Add additional trash receptacles.
2. Establish surface treatment for parking lot.

8.8 Shady Nook

Immediate Tasks

1. Fill in depressions in driveway, even out surface
2. Clean and repaint columns on shelter

Intermediate Tasks

1. Define a limit for parking
2. Repair picnic tables as necessary
3. Replace barbeque grills in need of repair with historic campfire grills.
4. Investigate feasibility for construction of a restroom building. If not feasible, remove portable toilets or build structure to hide them. If feasible, construct restroom building.



Figure 90 ~ Remnant of picnic shelter foundation at Shady Nook picnic area.

Long Term Tasks

1. Replace metal frame tables with stone base tables
2. Rebuild shelter to match historic shelter at Mayapple Hill. Keep footing of historic shelter and add interpretive signage.

8.9 Tulip Springs

Immediate Tasks

1. Clean and repaint columns on shelters.
2. Stripe parking spaces.
3. Add ADA accessible parking spaces.
4. Address erosion occurring from drive and parking towards the River.

Intermediate Tasks

1. Remove portable toilets
2. Repair/replace barbeque grills.

Long Term Tasks

1. Rehabilitate restroom, upgrade sanitary system as necessary
2. Replace picnic tables with 12 foot tables w/stone base

8.10 Boy Scout Camp

Intermediate Tasks

1. Repair structure as necessary
2. Remove outhouse if no longer functional
3. Add directional signage

8.11 Oakdale Picnic Area

(See also Buildings and Structures section 7.1)

Immediate Tasks

1. Stripe parking spaces and add ADA accessible spaces.
2. Move picnic tables out of areas affected by groundwater seepage
3. Repair picnic tables as necessary.
4. Replace barricade with gate.
5. Determine feasibility of reopening structure as a concession stand.
6. Provide access from the parking lot to Valley View Drive.

Intermediate Tasks

1. Move picnic tables from secondary area to main area
2. Replace equipment storage shed with building matching historical architecture
3. Rehabilitate structure as concession stand if found feasible.

8.12 Mayapple Hill

Immediate Tasks

1. Add identification and directional signage throughout area including roadway
2. Striping to delineate parking spaces
3. Add ADA accessible spaces
4. Repair drinking fountain in south picnic area.

5. Provide trail map, markers
6. Repair picnic tables as necessary

Intermediate Tasks

1. Add floor treatment to covered shelters.
2. Replace barbeque grills with campfire grills when the grills need to be replaced.
3. Add pedestrian connection to future residential development to the west.
4. Upgrade facilities for the athletic field.
5. Remove portable toilets from south picnic area, add pedestrian connection to restroom from south area.

Long Term Tasks

1. Rehabilitate/repair restroom facility.
2. Re-blaze the Lenape trail.

8.13 Turtle Back Picnic Area

Immediate Tasks

1. Add additional signage for identification, directional, and trail markers.
2. Reduce number of trash receptacles
3. Clean posts on shelter and repaint.
4. Stripe parking spaces, delineate traffic pattern and add ADA accessible spaces to parking lot.
5. Add gate at corner of parking lot where walking path (adjacent to open field) begins.
6. Restore fireplace grills.

Intermediate Tasks

1. Replace barbeque grills with campfire grills when the grills need to be replaced.
2. Upgrade softball field
3. Redefine interpretive trail signage and map.
4. Restore restroom to working condition and eliminate portable toilets.

Long Term Tasks

1. Add picnic tables; replace existing tables with 12' stone base tables.
2. Upon major repair replace shelter with historic shelter at Summit Field.

8.14 Girl Scout Camp

Immediate Tasks

1. Repair Bridge crossing Hemlock Brook

Intermediate Tasks

1. Repair buildings as necessary
2. Restore campfire grills.

9.0 WAYFINDING SYSTEM

The wayfinding system should be developed of a rustic design consistent with the materials and design of other historic structures still existent in the reservation today.

9.1 Signage

Signage should be kept to the minimum needed and should be developed with a clear and consistent hierarchy of sizes for various functions. A consistent language of form, color and graphic design should also be developed for the park. All entrances to the park should be clearly marked with such consistent signage. Informational signage could be placed at historically significant locations describing the location such as Washington Rock.

9.2 Map

A larger, two sided, folded map should be developed consistent with trail system and should include topography to aid in the Reservation User. Map should identify points of interest. Descriptions of the points of interest should be included. It should be developed to be reproduced in color and in black and white. The map could include a brief description of the Reservation and its history, the flora and fauna and the various recreational opportunities within the Reservation.

The map should be available at all trail head parking locations and picnic areas in map boxes with the major trail heads to have a kiosk where Reservation, County and community activities can be posted. The maps should also be located at County and local municipal facilities and libraries.

9.3 Tasks

Immediate Tasks (within 1 year)

1. Develop signage system and hierarchy.
2. Evaluate “desire paths” for removal, relocation or further development.
3. Fabricate and install trailhead map boxes and kiosks.
4. Develop and reproduce trail map

Intermediate Tasks (within 5 years)

1. Implement signage system program.

Long Term Tasks (within 10 years)

1. Continue to monitor public for creation of new trails and decommission.
2. Continued maintenance of signage.
3. Update map if trail realignment is implemented.

10.0 UTILITIES

Dialogue should be maintained with the City of Orange and West Orange Township to encourage any future work to modify the appearance of the utility structures and fences to be more in keeping with the historic character of the Reservation. The potential exists for a possible re-use of the treatment plant as a new use by the County such as a ranger station or for educational use. However any re-use would be dependent on cooperation with the City of Orange Township and a detailed analysis of the building in the form of a Historic Building Report. Any modification to the trail system needs to take into account where vehicular access is required by the water company for regular maintenance of the two water mains that traverse the Reservation. The existing sanitary system provides the opportunity to construct new restroom facilities as has been proposed in the past.

11.0 TIER ONE RECOMMENDATIONS – MANAGEMENT AREAS AND TASKS

When restoration and maintenance are being completed a holistic approach should be taken that address all of the areas of concern at the same time. i.e.: Trail and Forest Road Restoration and Drainage; Forest & Meadow Ecology; Aquatic Ecology; Historic Integrity; General Usage; Other Infrastructure; and Maintenance and Management Policies. These tasks should be implemented with design guidelines appropriate to the historic character of the Reservation. The design guidelines should be developed as a Tier Two immediate task prior to the implementation of the Tier One recommendations.

One overall task and three priority management areas were selected for the first year of the management plan. The areas selected were observed to be those for which immediate management efforts would save time and money if accomplished now. However, if these areas are not managed immediately, the areas will continue to deteriorate and require more costly management efforts in the future. The management areas include (A) Southern tip of the reservation from the southern boundary to Washington Rock to Maple Falls and River Trail, (B) Reservoir trail behind Turtle Back Zoo and Orange Reservoir and associated drainage courses and (C) Mayapple Hill (Map 4.2).

11.1 All areas disturbed due to ongoing maintenance activities within the Reservation:

As these areas are currently the focus of a number of improvement activities and crews will already be working in the area, the cost to manage these disturbed areas is relatively low, while the cost of doing nothing now and trying to manage the areas later after they have become overgrown with non-native and invasive species will be much higher.

Management Tools

After disturbance, seed area with native grass (and forbs, if appropriate) mixture appropriate for the area and plant native deer-resistant shrubs and trees. Increase forest diversity with the seeding and plantings.

Immediate Tasks (within 1 year)

1. Follow-through with fundraising strategy for anticipated projects including invasive species control.
2. Widen volunteer group membership base and introduce educational programs for volunteers, users and interested public to give them sufficient knowledge and tools to work within the historic and ecological contexts.

3. Keep the public, Essex County Administration and maintenance staff up to date on best management practices for the stewardship of South Mountain Reservation.
4. Implement the deer management program.
5. Employ invasive species and pest controls in areas disturbed during general maintenance activities. Plant disturbed areas with native vegetation that is less desirable to deer and based on the Olmsted plan
6. Employ an arborist or forester part-time (utilizing an existing employee of one of the neighboring towns) to monitor forest health and develop a baseline for environmental indicators.

Intermediate Tasks (within 5 years)

1. After deer population has been properly managed, begin reforestation and regeneration efforts with plantings of shrubs and saplings, with a focus on native species and increasing diversity.

Long Term Tasks (ongoing and within 10 years)

1. Continue to monitor forest health and regeneration.

11.2 Area A - Southern tip of the Reservation

This area is heavily used by the public, and areas of active erosion are evident throughout the trails and within the forest. The forest is evenly aged with little or no undergrowth, so when the current crop of trees die out there is concern that forest regeneration will not occur and the site will be overrun with non-native invasive species with little or no tree canopy, similar to what is now occurring at the base of the old quarry and in the area of Disturbed Forest.

Management Tools

Invasive Species and Pest Control

Within area indicated on Vegetative Cover Map as Disturbed Land, determine cause for tree deaths, remove invasive vegetation and pests, and replant with native deer-resistant vegetation.

Forest Regeneration and Erosion Control

Place dead wood parallel to slopes in areas with steep slopes and minimal understory. Conduct selective planting of native, deer-resistant trees and shrubs. Increase diversity with the plantings.

Immediate Tasks (within 1 year)

1. Employ invasive species and pest controls in areas disturbed during general maintenance activities. Plant disturbed areas with native vegetation that is undesirable to deer. Implement deer management program.
2. Employ an arborist or forester part-time (utilizing an existing employee of one of the neighboring towns) to monitor forest health and develop a baseline for environmental indicators, as well as investigate areas of tree death in upland areas to determine cause.
3. Clean out swales that run along trails and create exit points for flows into existing streams and tributaries so that the trails do not become the preferred water flow paths. Do not side-cast the debris if there is a chance it will reenter the system.
4. Remove culverts where maintenance cannot occur on recurring basis. This should be determined through further field and maintenance evaluations.
5. Minor Trail Improvements (by Essex County crews) – 1.4 miles.
6. Limited Trail Improvements (by Essex County crews) – 1.6 miles.
7. Moderate Trail Improvements – 0.2 miles
8. Major Trail Improvements – 1.2 miles
9. Bridge Repair – 2 structures.
10. Bridge Reconstruction – 1 structure
11. Repair trail failure on Locust Grove/ Lenape Trail connection. Utilize stepped pools up slope, dead wood staked parallel to cross slope and cobble crossings on trail.
12. Repair steps west of Washington Rock on the Lenape Trail.
13. Conduct studies to determine appropriateness of creating step pools at the heads of stream tributaries and weirs at the intersections of streams and tributaries.
14. Provide selective access to water bodies through strategic placement of plantings.
15. Place woody trunks and debris parallel to slope in unvegetated areas, and use stakes to hold in place to help build up forest litter.
16. Limit open canopy areas where invasive species tend to dominate. If area is intended to remain open, increase management to prevent invasive species from becoming dominate species through mowing or removal.

Intermediate Tasks (within 5 years)

1. After deer population has been properly managed, begin reforestation and regeneration efforts with plantings of shrubs and saplings, with a focus on native species and increasing diversity.
2. Revegetate riverine and lacustrine vegetation buffer to shade water bodies, with a focus on native species, diversity, and unattractiveness to deer.

Long Term Tasks (within 10 years)

1. Continue to monitor any trailside swales so that they function properly and do not send storm water flows down the trail system.
2. Continue to monitor forest health and regeneration.
3. Continue adding wood debris to slope sides, making sure it is firmly set in place and does not flow down the hillside.

11.3 Area B – Northeastern Section of the Reservation

Area B includes the area located near Reservoir Trail, Ravine Trail and Hillspur Trail, east of the zoo and Orange Reservoir. Areas of erosion are evident in this area, undercutting old stands of trees. The large movement of sediment out of this area will result in a shallow cover of topsoil and a loss of a number of large trees if allowed to continue. The current road and trail system were not designed to work with the existing steep topography and are causing additional scouring and erosion, creating an unstable environment.

Management Tools

Forest Regeneration and Erosion Control: Conduct selective planting of native, deer-resistant trees and shrubs. Increase diversity with the plantings. Increase maintenance of culverts, or remove culverts where maintenance not feasible. Stabilize steep slopes. Determine the potential for a small freshwater wetland area to increase storage and decrease sheet water flow.

Immediate Tasks (within 1 year)

1. Employ invasive species and pest controls in areas disturbed during general maintenance activities. Plant disturbed areas with native vegetation that is undesirable to deer.
2. Employ an arborist or forester part-time (utilizing an existing employee of one of the neighboring towns) to monitor forest health and develop a baseline for environmental indicators, as well as investigate areas of tree death in upland areas to determine cause.
3. Clean out swales that run along trails and create exit points for flows into existing streams and tributaries so that the trails do not become the preferred water flow paths. Do not side-cast the debris if there is a chance it will reenter the system.
4. Conduct studies to determine appropriateness of creating step pools at the head of stream tributaries and weirs at the intersections of streams and tributaries, particularly in the area of the Reservoir, Ravine and Hillspur Trails.
5. Investigate the feasibility of creating a freshwater retention wetland in the area west of the zoo for purposes of detaining some of the water flow to the river during storm events.
6. Discuss with the City of Orange the relocation of the Reservoir Trail off the hillside and closer to the reservoir for purposes of reducing stream disturbances and erosion.

Intermediate Tasks (within 5 years)

1. Implement stream restoration plans for the areas investigated during the previous phase.
2. If determined to be feasible, implement design and construction of freshwater retention wetland.
3. Remove and/or relocate trails with no historical significance to reduce stream disturbance and erosion.
4. Regrade trails to prevent storm flows from utilizing the trails as the preferred flow.
5. Minor Improvements (by Essex County crews) – 0.7 miles.
6. Limited Improvements (by Essex County crews) – 0.1 miles.
7. Moderate Improvements – 0.5 miles
8. Major Improvements – 0.8 miles

Long Term Tasks (ongoing and within 10 years)

1. Continue to monitor trails and trailside swales so that they function properly and do not send storm water flows down the trail system.
2. Continue to monitor forest health and regeneration.

11.4 Area C – Mayapple Hill

The area adjacent to Mayapple Hill is currently being developed, greatly increasing edge habitat and light penetration into the forest. Also, there is already a large proportion of open spaces and roadway relative to forest within this area, so that the amount of edge habitat provides a stronger presence than overall interior forest habitat. This area of the forest was the primary area where invasive trees were observed – while the trees are not yet dominant, management during this period would be cost efficient.

Management Tools

Invasive Species Control and Forest Regeneration

Conduct active management of invasive species, particularly along edges of forest. Increase diversity and close the canopy by selective planting of native trees and shrubs, utilizing tree tubes if necessary to allow for full growth of trees without deer browsing.

Immediate Tasks (within 1 year)

1. Employ invasive species and pest controls in areas disturbed during general maintenance activities. Plant disturbed areas with native vegetation that is undesirable to deer.
2. Employ an arborist or forester part-time (utilizing an existing employee of one of the neighboring towns) to monitor forest health and develop a baseline for environmental indicators.
3. Investigate stream running off site into new development in the northwest section of the area.
4. Minor Improvements (by Essex County crews) – 1.3 miles.
5. Limited Improvements (by Essex County crews) – 0.4 miles.
6. Moderate Improvements – 0.1 miles
7. Major Improvements – 0.3 miles

Intermediate Tasks (within 5 years)

1. Implement stream and wetland restoration plans for northwest section based on investigation conducted during the previous phase.
2. Increase diversity and protect edge habitat from invasive species by planting edges, particularly those along the newly developed areas to the west and removing undesirable vegetation.










Long Term Tasks (ongoing/within 10 years)

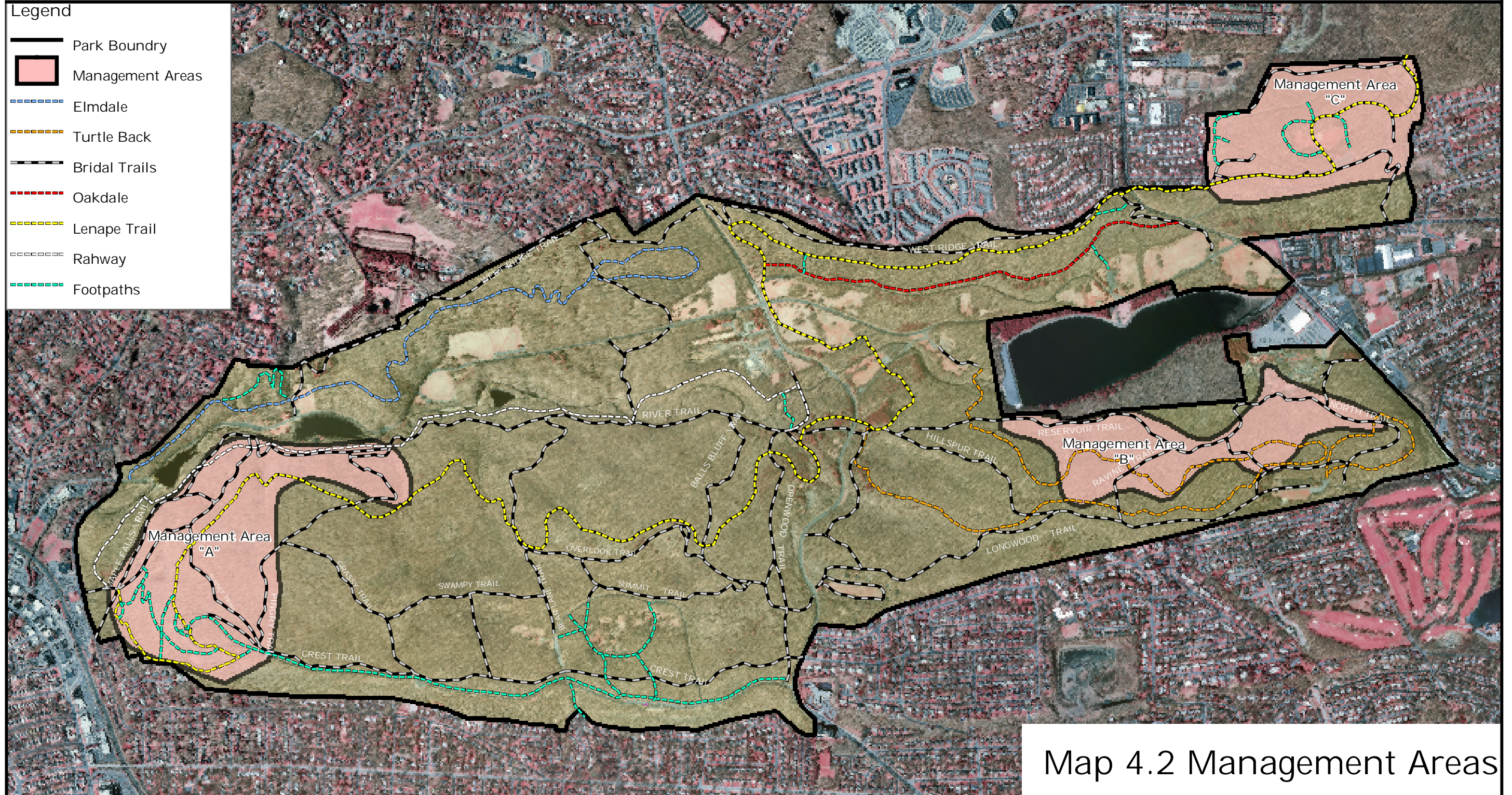
1. Continue to monitor forest health, managing invasive species and planting with desirable species where appropriate.

SOUTH MOUNTAIN RESERVATION

LANDSCAPE AND INFRASTRUCTURE ASSESSMENT AND RESTORATION MANAGEMENT PLAN

Legend

-  Park Boundry
-  Management Areas
-  Elmdale
-  Turtle Back
-  Bridal Trails
-  Oakdale
-  Lenape Trail
-  Rahway
-  Footpaths



Map 4.2 Management Areas

INFORMATION SOURCES: NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF GEOGRAPHIC INFORMATION SYSTEMS

<http://www.nj.gov/dep/gis/index.html>

NEW JERSEY IMAGE WHAREHOUSE
http://njig.nj.gov/OIT_IW/index.jsp



12.0 TIER TWO RECOMMENDATIONS – OVERALL RESERVATION TASKS

These tasks are to be completed concurrently with those in the Tier One Recommendations. Tier Two Recommendation tasks should be implemented with design guidelines appropriate to the historic character of the Reservation. These design guidelines are to be developed as an immediate task. The previous sections within this chapter also identify specific recommendations for individual reservation components such as the woodland, trails and buildings and structures.

12.1 Immediate Tasks (within 1 year)

1. Complete deer survey and implement deer management program.
2. Provide maintenance staff hours that will allow for maintenance of swales trailside, planting in areas of disturbance and repairing broken furnishings.
3. Hire a Certified Tree Expert (CTE) or arborist for the Reservation.
4. Commission a detailed geologic study to evaluate the feasibility of decreasing sheet flow by providing infiltration areas concentrating study in potential areas identified.
5. Continue conversations with NJDEP to finalize permit requirements for improvements identified within this study.
6. Complete a detailed investigation of the possible reason the trees that are dying in the southern section of the reservation.
7. Develop design guidelines for all improvements within the reservation including signage. This should be completed prior to the implementation of the Tier One Recommendations.
8. Reopen conversations with City of Orange regarding City holdings within the reservations such as Campbell Pond Dam, the historic pumping station and existing well houses.
9. Complete detailed research, documentation and treatment recommendations for the Reservations cultural resources as a part of each project completed in the Reservation. Incorporate treatment recommendations into the completion of each project.

12.2 Intermediate Tasks (within 5 years)

General

1. Implement creation of infiltration areas as determined feasible.
2. Develop a fundraising strategy for anticipated projects.
3. Enlist volunteer groups for improvement projects, water quality testing, and continued trash pick-up and erosion control measures.

4. Educate the public, Essex County Administration and maintenance staff on how the stewardship of South Mountain Reservation fits within the regional watershed.
5. Develop a baseline for environmental indicators.
6. Address remaining trail and forest road restoration and drainage major repair areas identified outside the two priority areas described below.
7. Invasive plant removal along forest perimeter areas.

Maintenance Investment and Management Policies

1. Continue deer management practices.
2. Maintenance of drainage swales and crossings.
3. Trail and forest road and drainage minor improvements
4. Trail and forest road and drainage limited improvements
5. Bridges Minor Repair

Aquatic Ecology

1. Stabilize West Branch of the Rahway River bank where trail network is close to river or decommission trail.
2. Plant material installation.
3. Provide access to water courses for fishing and discourage access at other locations.
4. Complete selective dredging where sediment is impacting trail network or water
5. Reinforce WBRR bed where there is potential for erosion such as at the end of a drainage structure and where secondary drainage channels enter the river.
6. Remove invasive vegetation along the banks.
7. Add floating islands.

13.0 MAINTENANCE AND MANAGEMENT RECOMMENDATIONS

13.1 Ecological Restoration Management

There can be a misunderstanding that ‘restoration’ of woodlands, can be accomplished as a discrete capital project designed, bid out and done within a short construction time of one year or less. This approach can be very destructive to woodlands and remnant habitats. Such an approach, by definition, concentrates site disturbance, involving removal of large amounts of vegetation all at once before initiating replanting and stabilization. A large project, done in a typical capital project manner, may span several seasons and even though it affects a portion of the site, may have a much larger impact.

Struggling natural vegetation is impacted. When forest restoration is viewed in the spirit of a capital project, the sheer amount of work undertaken becomes a severe stress to fragile remnant systems. Large-scale grading operations, extensive soil reworking, and massive planting efforts are, sources of disturbance and should be undertaken only where the landscape is in collapse, completely overwhelmed by invasive vegetation, or with severely and extensive erosion. Similarly, where the vegetation is a mix of desirable species and pests, complete elimination of all invasive vegetation at once may actually open up the landscape so much that a reinvasion, perhaps even greater in scale than before, is invited.

The habit of wholesale reconstruction is poorly suited to forest restoration. Forests themselves take a long time to develop. This approach also requires that the designer must make many assumptions about the site with very little information. Trees, for example, are routinely evaluated and only healthy specimen\’s preserved, yet in a natural landscape, many misshapen trees are the norm, and every stage from birth to mortality is found.

A common approach to dealing with these problems is fragmenting a project into smaller capital reconstruction pieces. However, though this confines damage to more limited areas at one time, it does not address the fact that this is simply a stressful way of working, and antithetical to establishing healthier, or self-sustaining natural systems.

Another difficult aspect of restoration to comprehend, and the reason behind many unsuccessful capital projects, is the assumption that a complex living system can simply be installed in a season or two and then requires only maintenance. This misperception also lies behind the idea that a detailed comprehensive plan should, or even can, be developed before any restoration is initiated. Effective woodland restoration should be carried out over the long-term. Many sensitive species should not be planted until greater levels of stability have been achieved. In some areas this will take many years because native canopy and understory layers need to be established before enhancement of more fragile ground layer vegetation can be undertaken. Elsewhere it is impossible to assess the potential of natural recovery processes until the destructive impacts of misuse and exotics are controlled. Restoring a

landscape is like raising a child; you can’t really do it all at once or even plan for it all at once. This appraisal, however, should not be taken to mean no planning is necessary, only that a continuing planning process, with assessment and revision over time, is more realistic than a fixed comprehensive plan. Long-term goals for each area must be reviewed and agreed upon in concept and a comprehensive plan developed for each set of management actions before they are initiated. The overall process must be clear even if every detail of every stage is not yet fully worked out.

An incremental design and implementation process should proceed holistically. A good analogy is the holograph, which is from the same root work. A holographic image has depth and is more realistic than a two-dimensional figure. When a holographic negative is cut in half, each piece bears a whole image, but with slightly less detail. No matter how small and how many pieces, the image is always whole. This process of landscape restoration is like putting the pieces of a cut negative back together again, making it whole once more. Each stage of the design process must be whole, but a greater level of detail will emerge at each level. The implementation process, and later the management process, should be as incremental as each proceeding step. This process flows rather than proceeding from one discreet phase to the next.

13.2 Maintenance

Maintenance is one of the most frequently discussed issues in park management and perceived of as one of the most intractable. There is no faster way to get an emphatic negative answer than by requesting a significant increase in a maintenance budget, yet virtual every problem that’s found in the Reservation woodlands, as well as most parks, for that matter, is ultimately tied to maintenance. Obviously, if the woodlands had been adequately maintained, there would be no need for wholesale ecological restoration. Yet, the willingness to spend money on new capital projects is matched only by the reluctance to spend for maintenance. Ironically, such capital projects, once finished, rarely receive the maintenance they require and typically deteriorate rapidly, which just continues the cycles of “restore/decline”, construction followed by neglect. This approach will be even less successful in the woodlands if the long-term goal is to establish relatively self-sustaining landscapes and largely native habitats. Even though designers today are urged to plant “low-maintenance’ landscapes, a new landscape needs continuing care especially during the establishment period –from planting up to 3-5 years after.

The difference between a conventional capital project approach and that required for effective long-term landscape management of the woodlands is very different. The approach which is needed for management and maintenance of woodland areas is labor intensive and is best done by individuals who are familiar with the site and have a clear understanding of the difference between a typical landscape and a woodland landscape.

The best model that is appropriate for management of the woodlands is a specially trained team supplemented with volunteers and targeted outside contractors. A specialized in-house

team dedicated to woodland management would get more “bang for the buck”, because good forest management is a lot more like maintenance than a traditional capital project.

Because there is no standardized training available in forest management, on-site workshops, on-the-job training and an established sequence of demonstration areas which can be monitored and evaluated is an effective way to initiate a woodland management effort and to provide proper training to staff and volunteers. Training efforts are also an excellent opportunity for the private sector involvement. The SMC could set up training workshops with outside experts. These training sessions would be for park staff, volunteers, park users as well as Conservancy members. Restoration efforts should be actively publicized and made the focus of volunteer work. Visitors should be informed about works sites, so they can observe the activities. Once a crew is established, their efforts should be coordinated with other existing or new programs, including adult education, trade school and youth training programs to develop a network of potential volunteers as well as future staff.

A difficult aspect of developing a woodland management crew is recruiting appropriate personnel. Existing staff do not necessarily have the appropriate training and there may be no appropriate advancement “within the system” for a qualified worker trained in ecological restoration over time. The job requires a thoughtful and trained staff that understand the resource that they are working with and their role in its ongoing management and maintenance.

The funding required to support a woodland management crew is considerable, though not when compared with a large capital landscape project. Typical park landscape maintenance costs can vary from \$.18¢/sq. ft to a high of \$2.25/sq. ft. The fact that a crew represents additions to the labor force can be an obstacle. This is an area where the South Mountain Conservancy has the opportunity to make a profound contribution. The Conservancy should seriously consider funding the senior person to head-up a woodland management team. The County could provide funding for other staff that would work under direct supervision of the Woodland supervisor.

13.2.1 Equipment

Proper equipment is important for proper maintenance of the woodlands. Even where path and rail design is adequate, additional problems may occur simply because maintenance vehicles are too large for woodland maintenance work. Trucks can erode and compact part margins. Vehicles used in the woodlands should be scaled-down to provide smaller vehicles suited for use on narrower and curvilinear woodland trails. Below are examples of the kinds of small vehicles that would be appropriate for use in the woodlands. The crews at the Reservation do not have this equipment available for their use. These or similar equipment should be purchased.



John Deere Utility Vehicle

Figure 91 ~ Recommended Equipment



E-Z-GO Utility Vehicle

Figure 92 ~ Recommended Equipment

Equipment list for the woodland maintenance

- Small tools including shovels, rakes, trowels, wheelbarrows, pick ax, etc;
- Weed wrenches for removal of invasive vegetation;
- Small utility vehicles as shown above (2);
- Pruning shears, pole saw, chain saw;
- Tow-behind water tank;
- Bobcat or similar small backhoe/loader;

13.2.2 Maintenance Costs

This report recommends a phased program of repair that includes trail repair, removal of invasive vegetation, erosion control, small-scale drainage improvements, etc. While some of the recommended improvements will require the use of outside contractors, much of the work will require a dedicated park crew and appropriate equipment supplemented with volunteers.

In our comparison with other parks, the Regional Parks in Pittsburgh are the closest comparison to South Mountain Reservation. Both Prospect Park and Central Park have tremendous pressure on their woodland areas due to the million of visitors to both Parks. Central Park averages more than 22 million annual visitors, while Prospect has over 13 million annual visitors. South Mountain Reservation will not likely have those levels of visitor numbers, but are similar to Pittsburgh’s woodland areas, that experience considerably less use. In addition, Pittsburgh’s total acreage of woodlands is much closer to SMR. Central and Prospect both have considerably fewer acres of woodlands.

If we then use Pittsburgh’s Regional Parks as a benchmark, we can begin to develop an estimated cost for woodland maintenance and ecological restoration. While Pittsburgh does have targeted resources for its woodlands, it’s still inadequate. In speaking with the Parks Director in Pittsburgh, he felt that an annual budget of \$650,000 would be an adequate baseline for maintenance of their woodlands, which equates to .007¢/sq. ft or \$350/acre.

Using an estimate benchmark of .007¢/sq. ft, we estimate an annual budget of \$650,000 will be needed for basic maintenance of the Reservation’s woodlands. This budget would provide the funding for a dedicated, adequately trained in-house woodland crew and park staff. See Table 10 for the breakdown of the recommended budget. Our benchmark of .007¢/sq. ft may need to be increased over time. As more people use the woodlands and a larger percentage of the woodlands have been restored, the cost of woodland maintenance may increase to .008¢/sq. ft, or \$750,000 annually.

As maintenance of the woodlands becomes established, the woodland supervisor could begin to “consult” on other County, such as Eagle Rock Reservation, or beyond South Mountain Reservation. While this report focuses on South Mountain Reservation, what occurs in adjacent woodlands can impact South Mountain Reservation. It has long been documented that diversity diminishes in landscape fragments which are isolated from larger areas of natural habitat. Very positive benefits to woodlands and the wildlife they support could be provided by establishing a network of habitat corridors connecting woodland areas to each other.

South Mountain Reservation Estimated Annual Budget				
Park Foreman	1	\$70,000	\$70,000	
Woodland Supervisor	1	\$60,000	\$60,000	
Woodland Crew	3	\$40,000	\$120,000	
Seasonal Staff (\$10/hr)	2	\$3,840	\$30,720	3-month seasonal staff, 40hrs/week
Repair Crew	1.5	\$40,000	\$60,000	Trades crew for repair of structures etc.
Laborer	1.5	\$30,000	\$45,000	Trash removal, cleaning of picnic areas
Groundskeeper	1	\$50,000	\$50,000	
Subtotal	11		\$435,720	
Materials & Supplies			100,000	
Contracted Services			\$75,000	Arborist, tree removal/pruning
Misc.			35,000	Costs could be shared with Municipalities
Subtotal			210,000	
Estimated Total Annual Budget			\$645,720	

* Salaries based on 2005 costs from County

Table 9 ~ South Mountain Reservation Estimated Annual Budget

Watchung Reservation, in Union County, has 2,065 acres and is a good comparison to South Mountain Reservation. They currently have 11 **full-time staff** allocated for maintenance of the

Reservation, which is our recommended staffing level for SMR. In Table 10 below is a summary of their resources.

Watchung Reservation Maintenance	Staff
Maintenance	8
Forestry	0.6
Horticulture Maintenance	0.6
Trades	1.8
Total Staffing	11

Table 10 ~ Watchung Reservation Maintenance Staff

In addition to the above staffing, Union County has a six person special projects team that work on drainage and major construction.

13.3 Woodland Structures – bridges, trails, shelters, etc.

Critically ill people in need of surgery often must wait until they have recovered acceptably to be strong enough to face the hardships of surgery. An analogous situation is faced in the woodlands. The ‘surgery’ these landscapes require – rebuilding the infrastructure—will be stressful. Trails must be rebuilt, drainage must be controlled, bridges, headwalls, shelters reconstructed. These activities, while stressful, cannot be avoided if the landscape is to be utilized.

Many of the features found in the woodlands require the same level of skill and sensitivity for the there reconstruction and maintenance as do the woodland’s natural systems. Skilled staff will be needed to rebuild the bridges, trails, shelters, and drainage systems in the woodlands. Woodland staff will need to be a multi-skilled with not only ecological restoration skills, but simple landscape construction skills such as the proper implanting of boulders in the landscape for erosion control, simple trail repair, simple carpentry skills, etc.

In addition, outside contractors will need the proper supervision for rebuilding of the shelters and masonry repair. Many of these structures will need rebuilding that’s beyond the capabilities of in-house staff. Contractor’s will the right skilled staff and proper supervision will be needed to ensure that any rebuilding is done appropriately using the proper construction techniques and materials. The woodland supervisor should be trained to provide the proper oversight over any in-house or contracted repair work that’s done in the woodlands. For larger structures such as the dams and picnic shelters, proper construction engineering services should be provided by the County or with a consultant construction supervisor with the proper training with historic materials and construction practices.

13.4 Education and Signage

Perhaps the greatest long-term opportunity to reduce stress on the Reservation's woodlands from trampling and misuse lies in the educational and public relations. The average individual's interest in environmental issues is growing steadily. Urban ecology is an ideal topic to develop further in programs and publications and would dovetail well with increasing public awareness and acceptance of ecological restoration efforts. Additional coordination with other park users such as mountain bikers and bird watching groups, rock climbers, etc. would greatly enhance efforts to develop a comprehensive public education effort.

The long-term sustenance of native habitats in the urban environment will require not only effective management, but also greater public sensitivity and awareness, which are best fostered by education, with every age group. Building respect for the woodlands through ecological restoration, good maintenance and engendering responsibility in the park user through consistent education will be fundamental to a comprehensive long-term woodland restoration effort.

Publications and programs that stress direct, firsthand, concrete experiences of the park are seen as a good foundation for building an understanding of natural phenomena. It takes time for children to learn, to think, and to change their attitudes and actions.

A significant aspect of public education is signage, about which there are many contradictory opinions. Adequate signage permits more effective enforcement and can mean the difference between success and failure.

Signage, of course, can be informative and attractive not just simply intrusive. Interpretive signage can be used in woodland areas that will contribute to the education of users and describe how fragile natural habitat areas are. Interpretive trails in the woodland areas would inform even the casual visitor about urban ecology, landscape management, and habitat restoration.

Temporary signage is ideal for use throughout woodland areas. Permanent signs can be located at major entry points, parking lots and picnic shelters, but temporary signs advising park users to remain on the path and explaining the damage that can be done by off-path trampling can be used judiciously throughout the woodlands. In addition, signs that explain ongoing ecological restoration efforts should be used in areas where ongoing work in progress.

13.5 Enforcement and Use

Use of the Reservation's woodlands is an important component of any restoration effort. It's difficult to justify the needed funds if, in fact, no one is going to benefit from any improvements. Park users, particularly with regards to the woodlands, directly affect the health of the woodlands. Inappropriate behavior, both intentional and inadvertent, are often

problematic. Activities such as off-trail use of bicycles and vehicles, off-trail trampling, erosion are the primary activities with can damage vegetation and disturb the soil. Encouraging appropriate use of the woodlands will be a management challenge.

A number of activities are being considered for SMR, in particular, mountain biking and rock climbing. Both activities are suitable to the SMR, but mountain biking, without any enforcement has the potential to inflict considerable damage on the woodland landscape. When left uncontrolled, off-trail mountain biking can be a serious problem. Many parks that we spoke with described sections of their woodlands that had been decimated because of off-trail mountain biking. Encouraging mountain biking without some kind of enforcement can be a dangerous

A special task force should be developed to devise a program to control off-trail use of bicycles. The effort should be initiated before off-trail use of bicycles becomes a problem and should be widely publicized. Bicycling restrictions should be delineated clearly on all signage and park guide materials. Log post along borders have been effective in deterring bicyclists and might be considered for South Mountain Reservation. Cooperation with any organized bicycle groups should be sought. Some kind of patrols should be initiated and citations issued if the park rules are not being followed. "Hot spots" should be targeted for extra patrols during likely periods of high use.

The Sourland Mountain Preserve, located in Somerset County, recently held an "Adopt-A-Boulder" Day. Bouldering is a form of rock-climbing and is considered by many to be the purest form of climbing. Bouldering is considered an environmentally friendly activity. An Adopt-An-Boulder event allows climbers and friends of climbing to map the bouldering and climbing resources, do trail work and to clean up trails and other park areas. Adopt-A-Boulder is sponsored by Access NJ, an affiliate of the Access Fund (which is a national non-profit climbing advocacy organization), is a State-wide grass roots organization dedicated to advocacy, promotion, stewardship, awareness, and education to protect New Jersey's State, County and Municipal climbing resources. Bouldering is an ideal use of the woodlands because of its low impact as well as the organizations commitment to preserving the natural resource.

13.6 Volunteer and Private Sector Opportunities

One of the highlights of the nationwide movement towards the development of parks conservancies in the last 20 years has been their ability to bring ecological restoration expertise to the public private partnership. In Louisville, for example, the Conservancy implemented planned burns to maintain a prairie habitat. In Brooklyn, the Prospect Park Alliance trained teenage neighbors to restore vegetation in fragile woods, resulting in minimal vandalism to the replanted areas because of a sense of ownership in the teen volunteers. In Central Park, the 90-acres of woodlands have seen a renewed effort towards their restoration

and maintenance. Volunteers, many of them school children, have put in countless hours doing small-scale maintenance and restoration. While we cannot make our parks bigger, we can, in fact, make more of our parks available to the public. Large woodland park areas, have typically, been underused and in poor condition. Restoration efforts make them healthy, scenic, accessible and safe to the public thereby enlarging our park areas for use. A restored woodland can bring the wonder of nature to urban parks users.

In Pittsburgh, due particularly to the very steep topography of the parks, the Pittsburgh Parks Conservancy (PPC) and the city are contending with 900 sloping acres of degraded woodlands that require intensive ecological restoration. Deteriorated underground drainage system of terra cotta pipes has failed causing erosion and allowing invasive plants to take hold. The PPC has worked to reestablish and sustain a healthy forest environment by repairing the drainage, stabilizing slopes to control erosion, and the removal of invasive plants and replace with native plants to reestablish a healthy biodiversity in the woodlands of the parks.

Woodland areas, by their nature, are fragile ecosystems and don't lend themselves to typical construction practices. Large machinery and standard construction practices and schedules are not applicable for woodlands and can, in fact, do more damage over the long-term. Best practices in monitoring and intervening appropriately in park woodland and meadow ecologies have been brought forward. Monitoring is needed to establish baseline conditions and from there to measure and verify the success of efforts to be added here. Ecological restoration is a long-term process requiring sound planning, monitoring, and coordinated staff and volunteer efforts using hand tools, small equipment and ongoing review and maintenance.

In Pittsburgh, through a generous grant from the Richard King Mellon Foundation, the PPC was able to recruit a national expert in the management of public landscapes, who is a certified arborist, trained professional (turf management, outdoor horticulture, arboriculture and ecological restoration) and former outdoor foreman at Longwood Gardens. Along with the City of Pittsburgh, they have effectively engaged both the professional and citizen volunteer communities in the initiation of an ecological renaissance in Pittsburgh's woodlands.

3.6.1 Collaboration in Ecological Restoration

While, historically, park crews tended to confine their work to mowing the grass and picking up the trash, today's best practices dictate that the park maintenance effort extends to every inch of the park in a manner appropriate to the particular landscape unit. A major area for cooperation among the SMC and the County could be in the area of ecological restoration and programming of the Reservation woodlands.

It is a common misunderstanding that "natural" areas of the parks can be left alone and nature will take care of them. Unfortunately, the woodlands have not avoided the influences of human impact even if they look "natural". Man's effect on nature has resulted in several issues for park woodlands. The growth of invasive species, deer over browse due to the elimination of predators, acid rain, erosion, runoff and non-point source pollution, to name a few, all have

deleterious effects on park woodlands. If not addressed, these problems--- taken to extreme-- can pollute park water bodies, create a monoculture of only a few types of aggressive vegetation and denude our park woodlands of the forest understory.

It is critically important for the long-term ecological health of the woodlands that these issues be addressed through the process known as "ecological restoration". This approach consists of stabilizing hillsides for erosion control; removing exotic invasive plants, replanting with native species, and reducing pollutants to improve water quality.

The joint training sessions that focus on ecological restoration could be developed and spearheaded by the Conservancy. Each entity now has individuals who have some level of knowledge of ecological restoration. That knowledge is enhanced by practical application of the principles learned. Holding a work day(s) that included County workers, Conservancy staff, and volunteers for a restoration project could further the sense of cooperation and camaraderie.

By bringing staff from both the County, SMC and volunteers to one job site and attacking the problem, the amount of work accomplished will be far greater than one entity working alone.

The woodlands and "ecological restoration" practices are also terrific opportunities for volunteers and to develop educational programs for schools, boy and girl scouts and other volunteer organizations. The willingness of County workers to accept the use of volunteers is crucial to developing and implementing volunteer initiatives without requiring cumbersome and time-consuming union approvals. Work days that were mentioned above could help to foster cooperation and camaraderie. In addition, joint training sessions that included County staff, Conservancy staff and volunteers would help to build a sense of team-work and mutual cooperation and understanding.

The South Mountain Conservancy should work with the Morris Land Conservancy's Partners for Park Program to build South Mountain Reservation's volunteer program. The award winning Partners for Park program recruits volunteers from civic groups and business for restoration efforts throughout Morris County and surrounding areas. This is a model program that can be applied to the Conservancy's volunteer program. The Partners for parks coordinator has volunteered to run the first couple of restoration efforts for the Conservancy to gain expertise in an effective program to recruit and retain volunteers.

Volunteer programs can:

- Increase public/private sector collaborative efforts;
- Augment public sector maintenance efforts;
- Develop new volunteer and programmatic opportunities;
- Increase public awareness;
- Provide satisfying visible results;
- Provide a team-building opportunity.

South Mountain Conservancy Initiatives include:

Immediate

1. Provide funding and schedule ecological training for County staff, volunteers, park users;
2. Develop a volunteer initiative (s) to help with removal of invasive vegetation, planting, and other ecological restoration efforts;
3. Assist the County with developing and implementing public programs that would occur in the woodlands;

Intermediate

1. Provide funding for Woodlands Director;
2. In cooperation with the County hire Woodlands Director;
3. Assist the County with developing, producing and maintaining a temporary signage program for the woodlands;
4. Provide some private funding for ecological restoration efforts that may include plants, specialized tools (weed wrench), small equipment, etc.

Long-term

1. Maintain a South Mountain Reservation website;
2. Assist the County with "Park Patrols" for enforcement of park rules and regulations;
3. Assist the County with interfacing with users of the woodlands, particularly mountain biking groups; the Conservancy may take the lead in organizing and chairing the mountain biking task force;

County Initiatives include:

Immediate

1. Of the staff currently working out of South Mountain, dedicate two (2) maintenance staff for maintenance of South Mountain Reservation;
2. Collaborate and support the South Mountain Conservancy in developing and implementing staff training for ecological restoration;
3. Schedule 3 ecological restoration training sessions;
4. Purchase appropriate maintenance vehicles and tools for woodland maintenance;
5. Increase budget for woodland maintenance to \$250,000;
6. Plan and support joint work projects with the Conservancy and volunteers for removal of invasive vegetation;

Intermediate

1. Develop woodland task force to proactively work with park users;
2. Collaborate with the Conservancy to hire woodland supervisor;
3. Expand dedicated woodland crew to 3 full-time personnel;
4. Increase budget for woodland maintenance to \$400,000;
5. Collaborate with the Conservancy to produce woodland signage program;
6. Purchase proper equipment for woodland maintenance;

Long-term

1. Increase woodland maintenance budget to \$650,000;
2. Continue to support Conservancy's efforts for collaboration of woodland maintenance;

14.0 OPINION OF PROBABLE COSTS

The following summary opinion of probable costs includes the costs for initial capital improvements, further studies and an allowance for implementation of work related to the various studies. A detailed breakdown of the associated costs is under separate cover.

Recommendations Tier 1

Area A - Southern tip of the Reservation	\$2,260,000
Area B - Northeastern Section of the Reservation	\$3,415,000
Area C - Mayapple Hill	\$1,840,000
TOTAL \$7,515,000	

Recommendations Tier 2

Noted Recommendations	\$11,960,000
TOTAL \$11,960,000	

Trail Improvements (Excluding Teir 1 Recommendations)

Limited trail restoration	\$200,000
Minor trail restoration	\$1,020,000
Moderate trail restoration	\$500,000
Major trail restoration	\$1,030,000
TOTAL \$2,750,000	

Trail Modifications (Excluding Teir 1 Recommendations)

Remove trail	\$300,000
Narrow Trail	\$250,000
Reestablish Trail	\$250,000
TOTAL \$800,000	

Overlooks/ View Points

Bow Point	\$250,000
Bramhall Terrace (Crest Drive)	\$350,000
Crest Drive Overlook	\$470,000
Overlook Point (Ball's Bluff)	\$480,000
Painters Point	\$1,870,000
Peak Hill Point	\$650,000
The Craig	\$520,000
Valley View Drive (Two views over Westfield)	\$550,000
Washington Rock	\$920,000
18 other view points noted	\$3,500,000
TOTAL \$9,560,000	

Use Areas

Brookside Drive	\$510,000
Dogwood Hillside	\$260,000
Elmdale Picnic Area	\$310,000
Girl Scout Camp	\$260,000
Hawk Hill	\$690,000
Locust Grove	\$455,000
Maintenance yard	\$220,000
Oakdale Picnic Area	\$1,360,000
Shady Nook Picnic Area	\$1,200,000
Summit Field Picnic Area	\$900,000
Tulip Springs	\$2,400,000
Turtle Back Picnic Area	\$1,200,000
TOTAL \$9,765,000	

SUB TOTAL \$42,350,000	
Design Contingency (20%)	\$8,500,000
Professional Fees (8%)	\$3,350,000
Construction Contingency (8%)	\$3,350,000
Contractor OH&P (6%)	\$3,450,000
Permit Allowance	\$500,000
GRAND TOTAL \$61,500,000	

APPENDIX



APPENDIX A - INVASIVE SPECIES

A number of invasive species were observed throughout the site. These species are described below along with potential management options for each species. The

***Acer platanoides* (Norway maple):** Norway maple has escaped cultivation and invades forests, fields, and other natural habitats, forming monotypic stands that create dense shade and displacing native trees, shrubs and herbs. The Norway maple is a quick-growing tree that has been widely planted. The leaves are seldom eaten or defaced by insects because the tree contains a sharp milky juice that they dislike.

Recommended control procedures: Do not plant Norway maple. To control existing stands, manual, mechanical and chemical means are available. Seedlings can be pulled by hand and small to large trees can be cut to the ground, repeating as necessary to control any re-growth from sprouts. Glyphosate and triclopyr herbicides have been successfully used to control Norway maple.

***Ailanthus altissima* (Tree-of-Heaven):** Tree-of-Heaven is an extremely common tree in urban areas where it can cause damage to sewers and structures but poses a greater environmental threat because of its invasiveness in cultivated fields and natural habitats. A prolific seeder, Tree-of-Heaven grows vigorously, establishing dense stands that displace native plants. It produces chemicals that kill or prevent other plants from growing in its vicinity.

Recommended control procedures: Elimination of Tree-of-Heaven requires diligence, due to its abundant seed production, high seed germination rate and vigorous vegetative reproduction. Targeting large female trees for control will help reduce spread by seed. Young seedlings may be pulled or dug up, preferably when soil is moist. Care must be taken to remove the entire plant including all roots and fragments as these will almost certainly re-grow.

***Berberis thunbergii* (Japanese Barberry):** Barberry forms dense stands in a variety of habitats, including closed canopy forests and open woodlands, wetlands, pastures, meadows and wastelands. This highly shade-tolerant exotic shrub displaces a variety of native herb and shrub species in areas where it is well established.

Recommended control procedures: Small plants can be pulled by hand, using thick gloves to avoid injury from the spines. A weed wrench ® can be used to uproot older shrubs when soil is moist. Shrubs can also be mowed or cut repeatedly. Treatment with systemic herbicides like glyphosate and triclopyr has been effective.

***Euonymus alata* (Winged Burning Bush):** Winged Burning Bush threatens a variety of habitats where it forms dense thickets, displacing many native woody and herbaceous plant species. Hundreds of seedlings are often found below the parent plant. The plant also colonizes by root suckers.

Recommended control procedures: Thoroughly wet all leaves with Arsenal AC or Vanquish as a 1-percent solution in water with a surfactant from April through October. For stems too tall for foliar sprays, apply Garlon 4 as a 20-percent solution in commercially available basal oil, diesel fuel, or with a penetrant to young bark as a basal spray (January to February or May to October). Or, cut large stems and immediately treat the stumps with one of the following herbicides in water with a surfactant: Arsenal AC* as a 10-percent solution or a glyphosate herbicide as a 20-percent solution.

***Rosa multiflora* (Multiflora Rose):** Multiflora rose was widely planted throughout the 20th century for erosion control, wildlife cover, and highway crash barriers. It tolerates a wide range of soil, moisture and light conditions and is able to invade many habitats. Multiflora rose grows aggressively and produces large numbers of fruits (hips) that are eaten and dispersed by a variety of birds, creating dense thickets that exclude most native shrubs and herbs from establishing and may be detrimental to nesting of native birds.

Recommended control procedures: Young plants may be pulled by hand, while mature plants can be controlled through frequent, repeated cutting or mowing. Several contact and systemic herbicides are also effective in controlling multiflora rose. Follow-up treatments are likely to be needed. Two naturally occurring biological controls affect multiflora rose to some extent: a native fungal pathogen (rose-rosette disease) that is spread by a tiny native mite and a non-native seed-infesting wasp, the European rose chalcid.

***Rubus phoenicolasius* (Wineberry):** Wineberry poses a threat to native flora because of its vigorous growth, which allows it to crowd out native plants and establish extensive patches.

Recommended control procedures: Do not plant wineberry. Wineberry can be controlled through mechanical means or by treating the canes with a systemic herbicide like glyphosate or triclopyr.

***Alliaria petiolata* (Garlic Mustard):** Garlic Mustard occurs in small to extensive colonies on floodplains, under forest canopies, and at forest margins and openings. It is shade tolerant and capable of ballistic seed dispersal of up to 10 feet. The seed can lie dormant for two to six years before germinating. Garlic Mustard is also allelopathic, emitting chemicals to kill surrounding plants and microbes.

Recommended control procedures: To control the growth of Garlic Mustard, thoroughly wet all leaves with a glyphosate herbicide as a 2-percent solution in water during flowering (April through June). Include a surfactant unless plants are near surface waters. In locations where herbicides cannot be used, pull plants before seed formation. Repeated annual prescribed burns in fall or early spring will control this plant, while “flaming” individual plants with propane torches has also shown preliminary success.

***Microstegium vimineum* (Japanese Stiltgrass):** Japanese Stiltgrass is common in many habitats and is very shade tolerant. It is a prolific seeder, producing hundreds of seeds that can remain viable in the soil for 5 or more years. It can spread on trails and recreational areas by hitchhiking on hikers’ and visitors’ shoes and clothes.

Recommended control procedures: Apply a glyphosate herbicide as a 2-percent solution in water with a surfactant in late summer. Or, apply an herbicide that requires more selective control and less impact on associated plants. Repeat treatments for several years to control abundant germinating seeds. Mowing or pulling just before seed set in September will prevent seed buildup.

***Phragmites australis* (Common Reed):** Common Reed threatens native ecosystems by displacing native plants and forming monocultures in otherwise biologically diverse ecosystems. It spreads by seed and strong vegetative growth and is very difficult to control once established.

Recommended control procedures: Control of Common Reed is difficult and costly. Cutting, burning and chemical herbicides are all used to control it under various circumstances, with varying degrees of success.

***Polygonum cuspidatum* (Japanese Knotweed):** Japanese Knotweed was first planted as an ornamental and used for erosion control and landscape screening. It can tolerate a variety of adverse conditions, including deep shade, high temperatures, high salinity and drought. It spreads quickly to form dense thickets that exclude native vegetation and greatly alter natural ecosystems. Once established, populations are extremely persistent.

Recommended control procedures: Japanese Knotweed is an extremely difficult plant to control due to its ability to re-grow from vegetative pieces and from seeds. Mechanical and chemical methods are most commonly used to eliminate it. Single young plants can be pulled

by hand depending on soil conditions and root development. All roots and runners must be removed to prevent re-sprouting. Glyphosate and triclopyr herbicides can be applied either to freshly cut stems or to foliage.

APPENDIX B – WATER QUALITY DATA FOR THE WEST BRANCH OF THE RAHWAY RIVER

Station: AN0192
Rahway R, Northfield Ave, W Orange, Essex County
Caldwell USGS Quadrangle
Date Sampled: 02/01/99

Family Tolerance Value (FTV)	Family	Number of Individuals
4	Planariidae	57
6	Chironomidae	22
6	Simuliidae	10
4	Hydropsychidae	5
8	Lumbriculidae	3
9	Coenagrionidae	1
8	Asellidae	1
	Blood Red	
8	Chironomidae	1
6	Empididae	1
10	Tubificidae	1
7	Physidae	1
		1

Observations

Streamwater: Clear....Flow: Moderate....Width/Depth (ft): 16/1
Substrate: Cobbles, mud....Stream Bank Vegetation/Stability: Trees,shrubs,grass/Unstable
Canopy: Mostly Open....Other: Urban; Water temp.0.5 / pH 7.5 /DO 16.2 /Cond.1339

Statistical Analysis

Number of Taxa: 11
Total Number of Individuals: 103
% Contribution of Dominant Family: 55.34 % (Planariidae)
Family Biotic Index: 4.97
Scraper/Filterer Collector Ratio: 0.07
Shredder/Total Ratio: 0.01
E+P+T (Ephemeroptera, Plecoptera, Trichoptera): 1
% EPT: 4.85
EPT/C: 0.21
NJIS Rating: 15
Biological Condition: Moderately Impaired
Habitat Analysis: 128
Deficiency(s) noted:
Paucity of Clean Water Organisms -

APPENDIX C – WATER QUALITY DATA FOR THE WEST BRANCH OF THE RAHWAY RIVER

http://oaspub.epa.gov/pls/tmdl/enviro.control?p_list_id=NJ_0048&p_cycle=2002

Cycle: 2002 State: NJ List ID: NJ_0048
 Water body Name: RAHWAY RIVER WEST BRANCH, WEST BRANCH RAHWAY RIVER
 State Basin Name: 14 ATLANTIC COAST, 07 RARITAN
 Listed Water Map Link: No Spatial Data

State List IDs:

Cycle	State List ID
2002	01393960

State Impairments:

State Impairment	Parent Impairment	Priority	Rank	Targeted Flag	Anticipated TMDL Submittal
COPPER	METALS	HIGH		N	
LEAD	METALS	HIGH		N	
ZINC	METALS	HIGH		N	
FECAL COLIFORM	PATHOGENS	HIGH		N	DEC-31-2005
TOTAL DISSOLVED SOLIDS	SALINITY/TDS/CHLORIDES	MEDIUM		N	DEC-31-2005
TOTAL PHOSPHORUS	PHOSPHORUS	MEDIUM		N	DEC-31-2005

Potential Sources of Impairment:

There were no potential sources reported to EPA by the state.

Total Maximum Daily Load (TMDL) Information:

Note: Click on the underlined TMDL Document Name for a detailed TMDL Document Report.

TMDL Document Name	Status	Actual TMDL Establishment Date	TMDL Pollutant Description	TMDL Pollutant Type	State Impairment	Impairment Cycle
RAHWAY RIVER W BR AT NORTHFIELD AVE AT WEST ORANGE	APPROVED/ESTABLISHED	SEP-23-2003	FECAL COLIFORM	NONPOINT SOURCE	FECAL COLIFORM	1998

Watershed Information:

There was no watershed information reported to EPA by the state.

APPENDIX D – NJDEP HABITAT ASSESSMENT EVALUATION CRITERIA

HABITAT ASSESSMENT FOR LOW GRADIENT STREAMS

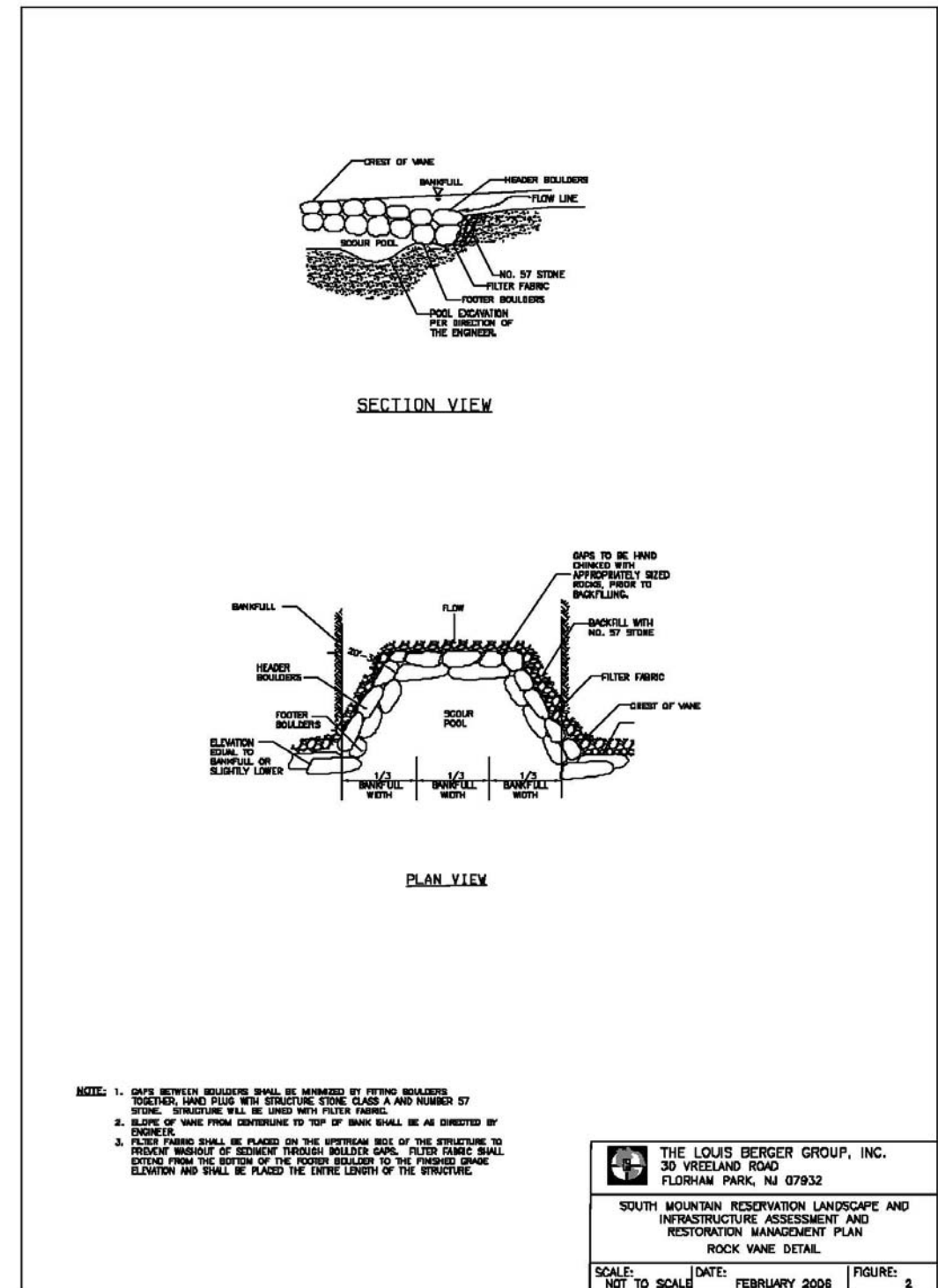
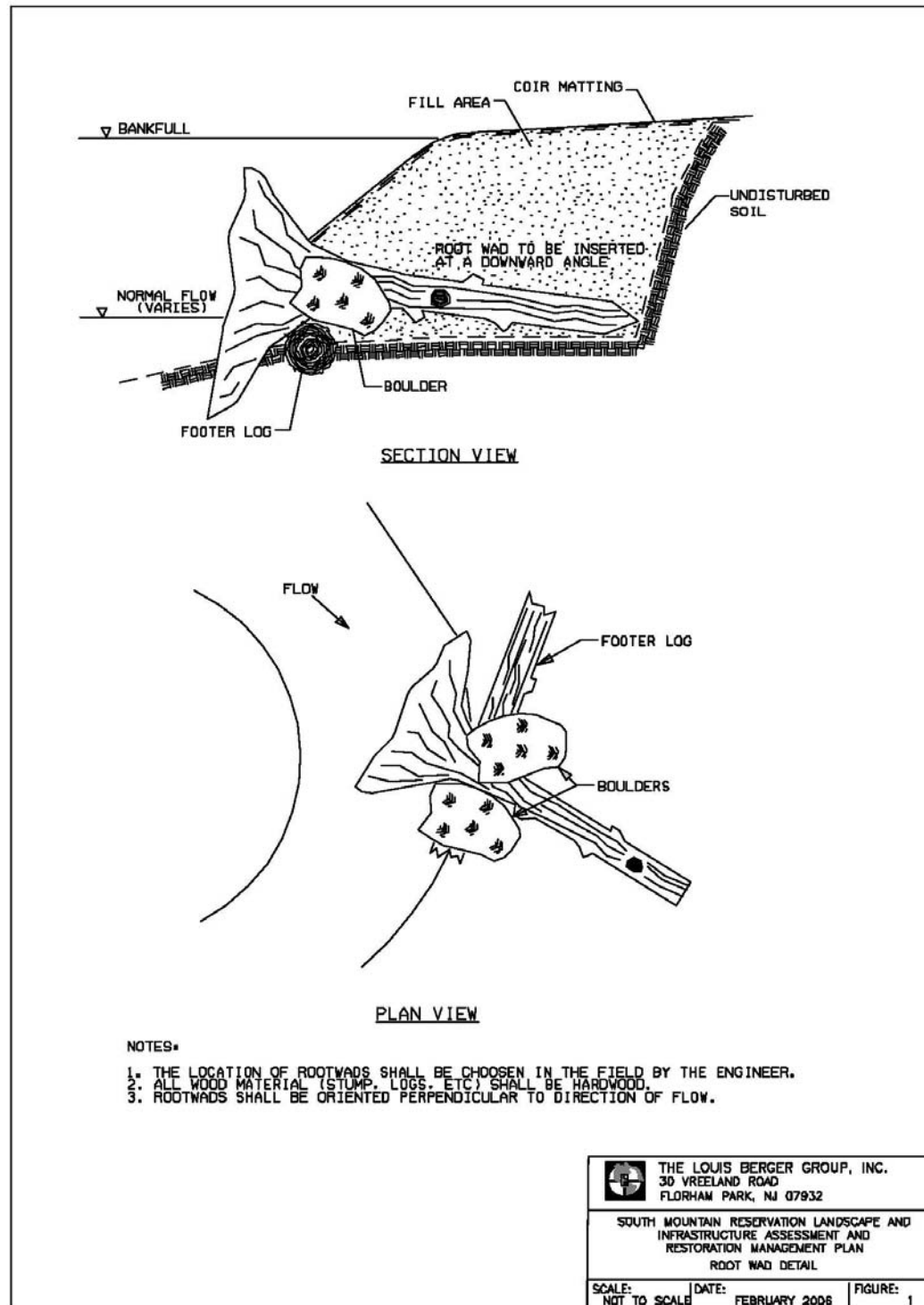
Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient).	30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% <20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

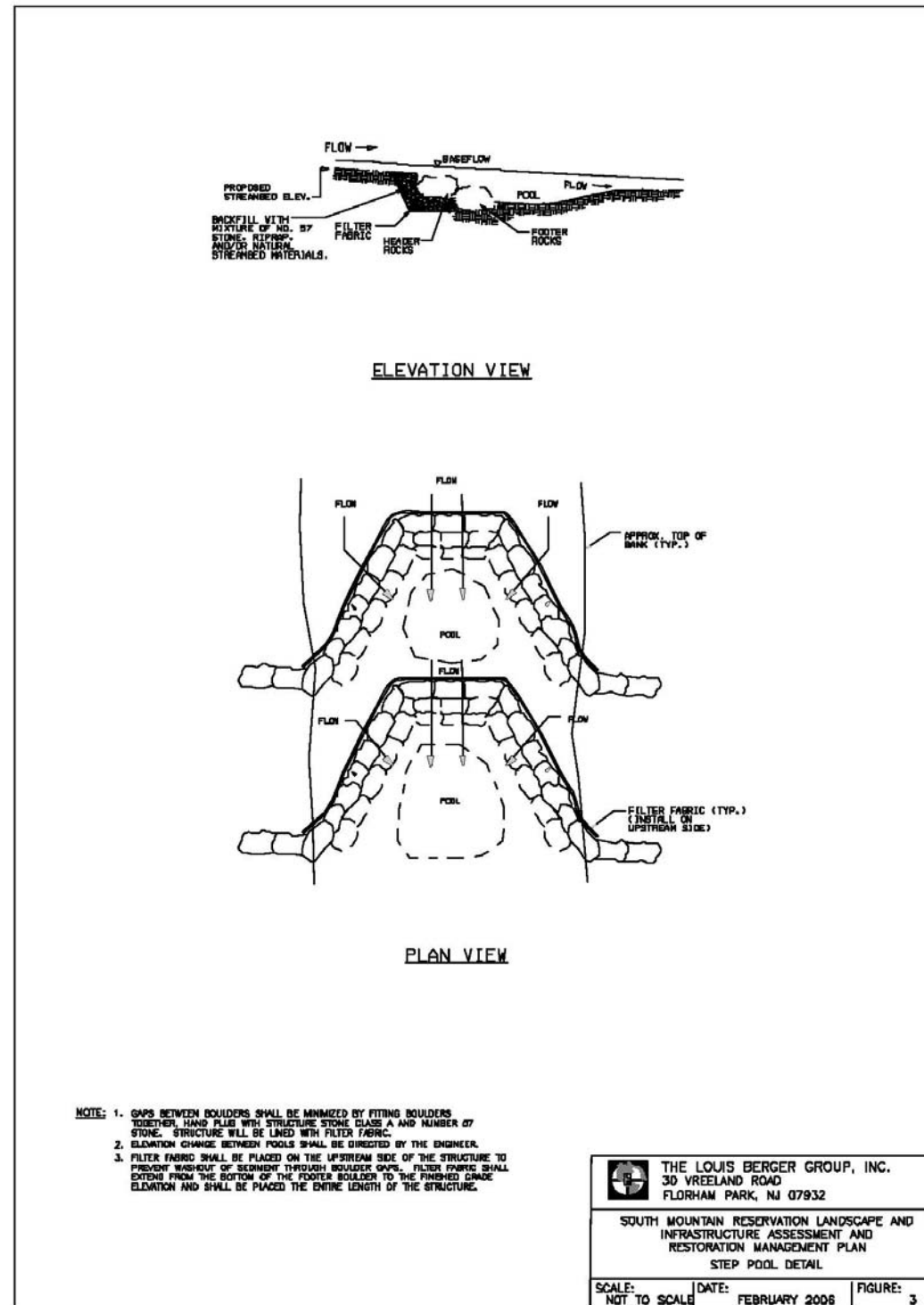
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yrs.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. In stream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.	The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ____ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ____ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Bank Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, under story shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ____ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ____ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.	
	SCORE ____ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
	SCORE ____ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

HABITAT SCORES	VALUE
OPTIMAL	160 - 200
SUB-OPTIMAL	110 - 159
MARGINAL	60 - 109
POOR	< 60

APPENDIX E - AQUATIC RESTORATION TOOLS





APPENDIX F - SURVEY TARGET POPULATION

Municipalities within 2 Miles of Reservation	
ZIP	Municipality
07039	Livingston Twsp.
07040	Maplewood Twsp.
07041	Millburn Twsp.
07050	City of Orange Twsp.
07052	West Orange Twsp.
07078	Millburn Twsp.
07079	South Orange Village Twsp.
07088	Union Twsp.
07083	Union Twsp.
07901	Summit City

* List of municipalities within 5 miles of the Reservation is inclusive of the list of municipalities within 2 miles of the Reservation.

Municipalities within 5 Miles of Reservation*	
ZIP	Municipality
07003	Bloomfield Twsp.
07006	West Caldwell Twsp, Caldwell and North Caldwell Boros
07016	Cranford Twsp.
07017	East Orange Twsp.
07018	East Orange Twsp.
07021	Essex Fells Boro
07027	Garwood Boro
07028	Glen Ridge Boro
07033	Kenilworth Boro
07039	Livingston Twsp.
07040	Maplewood Twsp.
07041	Millburn Twsp.
07042	Montclair Twsp.
07044	Verona Twsp.
07050	City of Orange Twsp.
07052	West Orange Twsp.
07068	Roseland Boro
07078	Millburn Twsp.
07079	South Orange Village Twsp.
07081	Springfield Twsp.
07083	Union Twsp.
07088	Union Twsp.
07090	Westfield Town
07092	Mountainside Boro
07103	Newark City
07106	Newark City
07108	Newark City
07111	Irvington Twsp.
07112	Newark City
07203	Roselle Boro
07204	Roselle Park Boro
07205	Hillside Twsp.
07901	Summit City
07928	Chatham Boro & Chatham Twsp.
07932	Florham Park Boro
07936	East Hanover Twsp.

APPENDIX G – DEER MANAGEMENT REPORT

South Mountain Reservation



Deer Management Report

Prepared for:
Department of Parks
Essex County, New Jersey



Prepared by:
The Louis Berger Group, Inc.
Florham Park, New Jersey
Teresa Doss, Ariusz Hornacki, and Margaret McBrien.



November 2005

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- IV. Work Cited **i**

I. Background Information

Deer are a major component of the landscape throughout the South Mountain Reservation, and appear to be overabundant in many areas. The Reservation acts as a deer refuge, providing habitat in an area dominated by suburban residential development. The undeveloped portions of the Reservation provide the deer with the essential requirements of food, cover and fresh water. Continued development in the areas around the Reservation, converting the small remnant patches of wooded areas to residential development, will increase the deer's dependence on the Reservation.

South Mountain Reservation Ecology and Deer

The ecology of the South Mountain Reservation indicates that this dependence may have caused the local deer populations to exceed an optimum density called the carrying capacity. Carrying capacity can be determined by three different standards. Cultural carrying capacity is commonly defined as the number of deer within a given area that the human population will tolerate. Residents in communities neighboring South Mountain Reservation appear to tolerate the deer, indicating that cultural carrying capacity has not been met. Biological carrying capacity is the population density that can be supported by the available habitat. As deer thrive and herd numbers continue to increase, biological carrying capacity of South Mountain Reservation does not appear to have been reached. Ecological carrying capacity is that deer density which the forest ecosystem can sustain. Exceeding the ecological carrying capacity impacts the populations of plants and other wildlife species, forest regeneration and water quality. In the Reservation, evidence such as low to absent natural forest regeneration suggests that the ecological carrying capacity has been exceeded.

From a population reduced to a handful of deer in the early 1900s, the deer have rebounded within Essex County during the latter part of the 20th century. A deer survey conducted in March 2004 revealed a population density of 63 deer per square mile, or roughly 200 deer (Predl 2005). Since then, the females have given birth to one to three fawns, raising the possible number of deer to 300, or 93 deer per square mile. These populations have been browsing on the understory of the forest at levels that are changing the vegetative species composition and disrupting the natural landscape, the visitor's visual experience, and historic scene value of many areas.

The impact of a high deer population on the forest vegetation within the Reservation is largely evident in the understory layers where they have the highest and most immediate impact. The dense vegetation layer, presence of tree seedlings, forbs, shrubs, and wildflowers, even the accumulation of fallen leaves that forms much of the litter layer on the forest floor, has largely disappeared within most areas of the Reservation. Areas where trees are dying are not regenerating, largely due to browse of new seedlings. The areas with the most abundant understory are the areas containing freshwater forested wetlands and areas dominated by an invasive understory, typically in areas where the tree canopy is thin or nonexistent.

Deer are herbivorous, and deer browsing increases the threat that invasive herbaceous species will out-compete native species because preferred deer foods are generally native plants. As the

habitat within the reservation continues to change, it will affect the ecosystem's capacity to support native species. Other wildlife also depend upon the ecology of the area.

Deer Overpopulation

The relatively high reproductive rate of white-tailed deer makes population control by natural predators unlikely. In the absence of hunting or other significant mortality, and with the continued development in the areas surrounding the Reservation, these local populations will continue to increase. Overabundant deer herds run a much higher risk of disease outbreak, parasites, and winter die-offs (from starvation). In addition, studies have shown that at high densities the resulting social disorder increases competition for available food, increases energy expenditure, decreases fawn survival, decreases antler growth in bucks, and reduces the overall health of the herd.

One of the risks associated with overpopulation is the threat of rapid spread of disease. Of current concern is Chronic Wasting Disease, a transmissible neurological disease of deer and elk that produces small lesions in brains of infected animals, resulting in symptoms similar to those observed in cattle and sheep infected with bovine spongiform encephalopathy (BSE), or Mad Cow Disease. The NJDEP announced this spring that although Chronic Wasting Disease was discovered in captive deer herds in New York, there is no immediate threat to the deer herd in New Jersey.

Deer and Lyme Disease

Many mammals, including deer, can host the tick (*Ixodes* species) responsible for transmitting Lyme disease, an infectious illness that is transmitted to animals and humans by the bite of the black-legged tick. The tick feeds on many animals including mice and domestic animals. Research suggests that there is evidence that an increased deer population can increase the number of ticks in an area. However, there is also evidence that once ticks are present, reducing deer numbers can have a slight or a negative effect on reducing the numbers of ticks. Killing deer may increase the amount of food and cover available for mice, birds and other hosts, which in turn will boost their numbers and escalate the spread of the disease. In fact, [The American Lyme Disease Foundation](#) has stated that it does not recommend killing deer as a way to control Lyme disease. Rather, results suggest that efforts to reduce the risk of Lyme disease should be directed toward decreasing fragmentation of deciduous forests by creating forested areas greater than five acres.

II. Deer Management Options

Choosing an appropriate management program to address high deer populations in urban and suburban communities must take into account local interests, personal values, and community

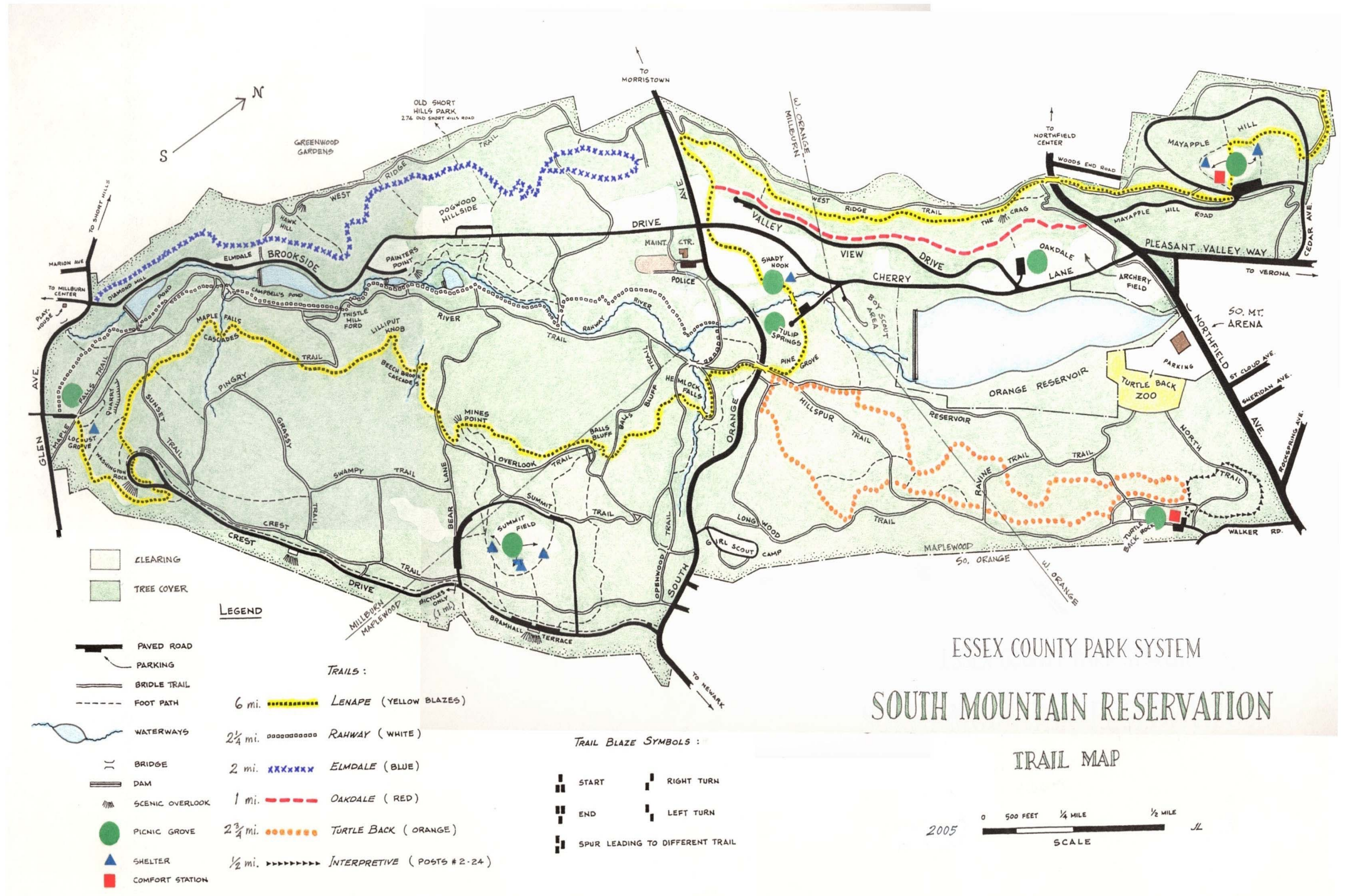


Figure 1 South Mountain Reservation Trail Map

objectives. Residents who support active deer management programs, such as hunting, should have the same opportunity to express their views as people who defend more passive measures. Only after reviewing all available management programs can communities determine the best-fit option in addressing the problem of overpopulation.

Many of the options presented below have been researched and studied by various academic and governmental institutions. A majority of the report is based on work completed by the New Jersey Agricultural Experiment Station of Rutgers University (www.deer.rutgers.edu) and is supported by findings reported by neighboring state environmental departments.

Studies conducted in national forests in Pennsylvania suggest deer densities in excess of 20 deer per square mile will prevent natural forest regeneration (Predl 2005). Cost-per-option calculations done for South Mountain Reservation utilized a value of 235 (or 73 deer per square mile) to reflect the number of deer that need to be eliminated, by lethal or non-lethal methods, to secure an optimal deer density.

Natural Course

One option currently employed in urban/suburban settings is the 'natural course' or 'hands-off' policy. Based upon the belief that natural selection and other forces will control the population, advocates for this option feel that wildlife should not be managed and/or do not perceive deer to be a problem.

True to its name, 'natural course' requires no financial expenditure for management costs. Chances to view and interact with deer increase as the population becomes larger and less wary of human presence. In addition, increased deer sightings add to the 'wild' experience sought after by many who visit South Mountain Reservation.

However, other aspects of community life will incur costs due to the increased deer pressure. Additional food sources, including vegetation crucial to other wildlife species, ornamental plants in residential properties, and agricultural crops, would be consumed to support the growing populations. Car accidents involving deer will no doubt increase as a result of higher deer numbers. More residents will potentially be exposed to Lyme disease, as more deer move into neighborhoods searching for food.

Repellants

Deer repellants are applied on or around plant material with the objective of deterring deer browse or disrupting their feeding behavior (Conover and Kania 1988; Craven and Hygnstrom 1994). Contact repellants (applied directly to the plant) and area repellants (placed in the vicinity of the vegetation) discourage deer from eating vegetation by attacking their gustatory (taste) and olfactory (smell) faculties, respectively. Most commercial brands of repellants are chemical in nature, and are governed by the same regulations as pesticides regarding registration and application. The most effective repellants have been shown to reduce deer damage by less than 60% (El Hani and Conover 1995).

Use of repellants provides communities with a deer management alternative that is more active than the 'natural course' method, but does not require direct physical interaction with deer. Repellants are most cost-effective when used in small areas with low deer numbers, light to moderate deer damage, with no more than 2 or 3 applications necessary (West Virginia Division of Natural Resources 1998). Protection against deer browse with repellants is most effective when used in small planting areas of special concern such as vegetable and ornamental gardens, nurseries, and orchards (Maryland Department of Natural Resources 1995).



Courtesy of DeNicola et al. 2000.

Overall repellant effectiveness, however, is highly variable when accounting for climate, deer density, availability of alternate food, repellant choice and various other factors (El Hani and Conover 1995). Deer often ignore repellants as deer density and competition for food increases (New York State Department of Environmental Conservation 1999). Contact repellants must be repeatedly applied for maximum effectiveness (Monmouth County Park System 2005), especially on unprotected new growth and after rainfall. Noxious and offensive residues may persist for some time after application, causing discomfort to people who come in contact with the chemicals (New York State Department of Environmental Conservation 1999).

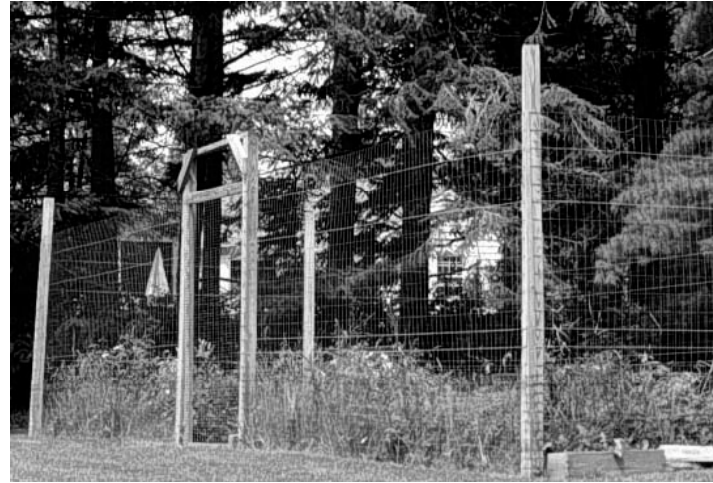
Research conducted in New York and Connecticut on repellant application in orchards and nurseries found the cost to range from \$18 to \$396 per acre for a single application (Maryland Department of Natural Resources 1995). Large acreages associated with areas like South Mountain Reservation diminish cost-effectiveness of repellant use.

Fencing

Temporary and permanent deer fences can effectively protect plant materials from deer browse as well as drivers from deer migrating across busy roadways. In some instances, an electric current can be applied to fences as an additional deterrent against aggressive deer. Temporary fences are less expensive than permanent ones, but permanent fences can last 5 to 20 years with proper maintenance, depending on design and materials (Craven and Hygnstrom 1994).

Each type of fence provides certain advantages over the other. Temporary fences are relatively cheap, easy to install, and can be moved to protect different areas. Permanent fences require less maintenance and can provide very effective deer control when properly maintained. The cost of establishing a deer fence may eventually pay for itself over time when used to protect high-valued planting areas such as orchards or nurseries (Maryland Department of Natural Resources 1995).

Certain disadvantages characterize individual fence types as well. Temporary fences require much more maintenance than permanent ones, while materials and installation costs for permanent fences are much higher. Both types must be constructed high enough to compensate for the deer's ability to jump 8 to 10 feet in a single leap. Chargers providing current to electric fences require additional safety measures to prevent accidents (human and pet contact, short-circuit fires, etc.) and loss of service. An imposing fence structure could have a negative impact on the aesthetic value of the areas where people go to enjoy the 'natural' views and 'wilderness' experience.



Courtesy of DeNicola et al. 2000.

Proper fence installation and maintenance can be very expensive. Areas greater than 50 acres in size usually require high tensile woven wire fencing (DeNicola et al. 2000), and installation costs can range from \$2.00 to \$4.00 per linear foot (material cost only) up to \$5.00 to \$7.50 per linear foot (including labor) (Grande et al. 2004; Michigan State University Extension 1998; Pierce and Wiggers 2005). Monmouth County Park System in New Jersey spent \$111,000 to install a fence around the 52-acre Deep Cut Gardens, one of the county's smallest parks, but determined the cost was too great to install fences in their larger parks. Additional feasibility costs may be incurred to determine whether the soil types and topography can support a properly-maintained deer fence.

Habitat Modification

Management programs that address both deer movement and browse pressure utilize habitat modifications to passively relocate deer. Deer typically prefer ecotones, or transition areas between two adjacent ecological communities. Altering where a deer lives and what it eats can be an effective way of dealing with the deer problem. Eliminating cover and forage vegetation would force deer to find cover and food elsewhere, preferably in more rural surroundings. On the other hand, creating cover and forage areas in other parts of the region can draw the deer away from suburban and urban food sources. Oftentimes, habitat modification is utilized near roadways to prevent deer-vehicle collisions (Putnam 1997; Romin and Bissonette 1996) and to replace heavily-browsed plants in landscaping (Craven and Hygnstrom 1994).

Habitat modification has been very successful as a prevention measure against rising deer-vehicle collisions (Jaren et al. 1991; Romin and Bissonette 1996; Wood and Wolfe 1988). Removing palatable vegetation from the side of roadways also increases driver visibility, which in turn could also increase driver reaction time (Waring et al. 1991). Rural areas that experience deer population

explosions sometimes employ habitat modification to protect their investments. Installing a 'buffer crop' can effectively direct deer feeding away from high value crops (Maryland Department of Natural Resources 1995).

Habitat modification may prove impractical in developed urban/suburban communities. Modifying ecotones where deer thrive could cause migration into expensively-landscaped neighborhoods, where browsing can cause extensive property damage. Eliminating desirable plants from the landscape will only delay the inevitable; deer will consume less desirable plants if available and whenever necessary. Altering vegetation to manage deer may have a negative impact on other wildlife that utilizes the vegetation for shelter and nourishment, especially in parks (Monmouth County Park System 2005). Other possible consequences of habitat modification include the spread of invasive plants and animals which may compete with native species for available resources.

Estimated costs for transforming whole parcels of forest to deter deer are high. When considerations are given to planning, material, and labor, figures can range from \$5,000 to \$10,000 per acre. Depending upon the objectives of the community, the high costs include removing the favored understory and replacing it with undesirable cover that can still fulfill certain environmental criteria, such as forage and cover for other wildlife, soil stabilization, and other forest ecosystem processes.

Trap and Translocation

Contrary to the previously-mentioned deer management options, this management option reduces deer numbers by actively and physically trapping the deer in the winter season and moving them from one location to another. Trapping methods include the following: box traps, clover traps, netted cage traps, drive nets, drop nets, rocket nets, corral traps, net guns, and immobilization (tranquilizer) darts. A deer entrapment area has already been established within South Mountain Reservation.

Trap and translocation offers communities very little, if any, advantages over other management options. Studies have shown that capture and relocation efforts can cause unwarranted stress to trapped animals, ultimately resulting in death (Beringer et al. 1996; Bryant and Ishmael 1991; Cromwell et al. 1999; Jones and Witham 1990). Many relocation areas within a reasonable distance



Courtesy of DeNicola et al. 2000.

from suburban communities are already overpopulated, causing residents to oppose releases. Once an accommodating area is located, extra efforts must be made so that the deer can acclimatize to the new environment. Newly-transported deer may be in poor physical condition resulting from the transportation (New York State Department of Environmental Conservation 1999), increasing the risk of collisions with vehicles caused by long-distance roaming in search of food (Craven et al. 1998), and may become a nuisance in other suburban communities similar to their original 'homes' (Cromwell et al. 1999). Deer farms may

provide sanctuary for a while, until the deer is ultimately slaughtered to provide meat for the venison market. Even so, many farm owners are cautious of accepting deer from other areas of the country, which can increase the chances of exposing domestic stock to diseases such as Chronic Wasting Disease and tuberculosis (Maryland Department of Natural Resources 1995). Eventually, deer numbers would decrease and deer become wary, making trapping efforts less efficient and more costly (New York State Department of Environmental Conservation 1999).

Coupled with the negative physical effects on the deer, the financial expenses of trapping and translocating deer could compound the overall costs of trapping and translocating deer. Ranging from \$110 to almost \$3,000 per deer (Drummond 1995; Ishmael and Rongstad 1984; Ishmael et al. 1995; Mayer et al. 1995), these figures do not reflect the rising cost of gasoline.

Contraception

Contrary to false information perpetrated by certain groups and individuals, there are no commercial reproductive control products available to manage deer on a large-scale (DeNicola et al. 2000). Currently, deer reproductive control methods are only available after approval by the State Division of Fish and Wildlife under the guidelines of the Community-Based Deer Management Program, and is limited to controlled experimental studies approved by the federal Food and Drug Administration (Monmouth County Parks System 2005). Besides sterilization, which is 100% effective and permanent, two other methods of contraception are currently being studied: contragestation and immunocontraceptives. Researchers in contragestation studies administer drugs like Prostaglandin (PGF2a) and Gonadotropin-Releasing Hormone (GnRH) after conception to terminate the pregnancy (DeNicola 1996; DeNicola et al. 1997; Miller et al. 1998).

Immunocontraceptives are fertility-controlling drugs like Porcine Zona Pellucida (PZP) and Gonadotropin-Releasing Hormone (GnRH) which stimulate production of antibodies that interfere with proteins and hormones necessary for reproduction (Miller et al. 1998; Talwar and Gaur 1987; Turner et al. 1992).

In the limited studies done throughout the country, results have shown contragestation to be a safe and effective contraceptive tool (Becker and Katz 1994; DeNicola et al. 1997). Immunocontraception research results were somewhat mixed, but success in controlling deer have been reported (Turner et al. 1992). Surgical sterilization is 100% effective, and unlike the other two methods, does not need to be repeatedly administered.

Due to the early stages of research, most of the disadvantages associated with contraception are scale-sensitive; because most studies are done on a limited number of deer in relatively 'controlled' settings, similar results are not expected when the scope and range of experimental units are expanded (Nielson et al. 1997). Contraception treatments last only about 1 to 2 years. Delivery methods raise questions of safety and cost-effectiveness. Implanting the drugs into the animals requires substantial input of time and money, and can be stressful on the animal, whereas dart delivery in suburban areas can cause safety concerns if darts miss the target and are lost (New York State Department of Environmental Conservation 1999). Perhaps the most striking argument against contraception is that the treatments do not address the issue of current high deer numbers (DeNicola et al. 2000; New York State Department of Environmental Conservation 1999; Maryland Department of Natural Resources 1995; Monmouth County Parks System 2005; Nielson et al. 1997). Contraception can be used to effectively control future populations, but other management options must be employed to manage present populations.



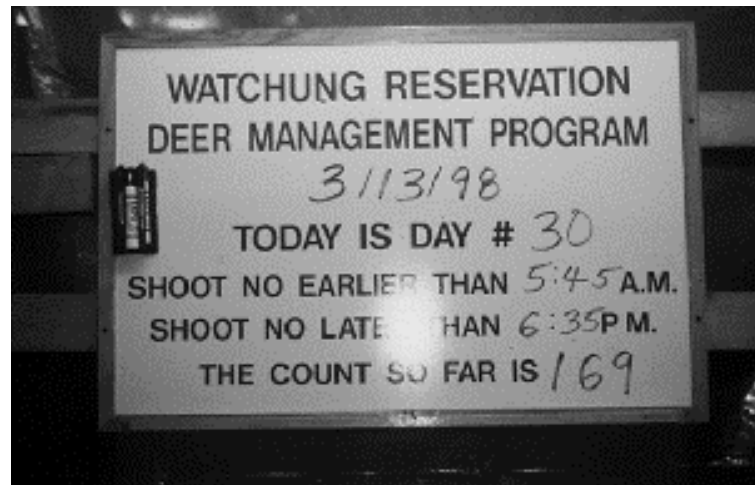
Courtesy of DeNicola et al. 2000.

Contraception costs reported for most studies take into account the cost of buying the vaccine and administering it to the deer. For most of the studies, reported costs ranged from \$430 to \$1,000 per deer (Peck and Stahl 1997; Schantz et al. 2001). Costs for areas with large deer numbers would have to decrease their numbers down to manageable levels before calculating costs.

Regulated and Controlled Hunting

No other deer management option elicits more controversy than hunting. Regulated hunting, also known as traditional or sport hunting, allows hunters to harvest deer with legal bows or shotguns

according to the rules set forth by the respective state wildlife managing agency. Hunters must successfully pass a hunter education course, which stresses safety and ethics. Proper hunting procedures require hunters to safely bring the deer down, tag the deer with a purchased tag, record all required information, including time and location of kill, and bring the animal to a check-in station for a state game or wildlife official to record additional information. Controlled hunting is a form of deer management where regulated or traditional hunting is done under more controlled, precautionary conditions (Ellingwood 1991; Monmouth County Parks System 2005). Conditions could include restrictions on hunter density, limiting the hunting area, and choice of hunting tools. Hunters are chosen according to guidelines established for a particular controlled hunt to minimize conflicts with the public and other hunters, which can include a selection process based on hunting experience, proficiency, and personal disposition (Kilpatrick et al. 1997; Kilpatrick and Walter 1999).



Courtesy of Rutgers Cooperative Extension 2001.

on large tracts of land where other management options are too costly and unsafe (Kilpatrick et al. 1997; Kilpatrick and Walter 1999; Mitchell et al. 1997). Programs such as the Community-Based Deer Management Program have been used to successfully control deer populations in New Jersey municipalities like Millburn, Bernards, Bridgewater, Watchung, Mountain Lakes and Summit (New Jersey Department of Environmental Protection 2005).

The United States Fish and Wildlife Service (1998) has determined that regulated hunting is the only deer management practice where the benefits outweigh the costs. Deer hunting in Maryland has a fiscal impact of \$209 million and provides for 3,250 jobs (Maryland Department of Natural Resources 1995). Minimal costs are associated with paying state game officials to fulfill their job requirements, which includes occupying deer check stations, enforcing hunting laws, and administering hunting licenses. As a management tool, it is sometimes seen as ineffective in controlling deer numbers. However, fault lies not with the actual act of hunting, but with the obstacles to hunting, such as limited access to hunting areas, local ordinances banning hunting and/or discharge of firearms, or public opposition. Regulated and controlled hunting as a management tool is controversial, and most of the disadvantages associated with this option focus on minimizing opposition, protests, and conflicts. When necessary, intensive involvement of state

Agencies responsible for deer management can control the number of deer harvested annually to maintain the carrying capacity of manageable areas. Regulated hunting seasons can be manipulated to control deer harvest numbers, and extensions are usually granted when state officials deem it necessary to harvest more deer. Unlike other deer management options, regulated hunting provides local and state economies with significant revenues through the sale of hunting licenses and hunting-related equipment. Controlled hunting can be used to manage deer

and local agencies and law enforcement is required for controlled hunts (DeNicola et al. 2000). Constant vigilance is required so that trespassers, protestors, and vandals do not enter the hunting area and invoke harm on themselves as well as on the hunters.

Controlled hunts in New Jersey and Massachusetts ranged from \$200 to \$622 per deer (Deblinger et al. 1995; Sigmund and Bernier 1994). However, large portion of the costs were used to control anti-hunting protestors. Other controlled hunt studies found that costs actually ranged from \$11 to \$86 per deer (Kilpatrick and Walter 1999; Peck and Stahl 1997).

Sharpshooting

Sharpshooting as an effective, lethal deer management tool creates almost as much controversy as hunting. Trained professionals use noise-suppressed firearms or archery equipment to harvest deer at close ranges, usually from an elevated position, in a controlled setting. Bait stations are used to draw deer to within the 10- to 30-yard shooting range. Considerable success in managing deer herds has been documented in numerous studies (Butfiloski et al. 1997; Deblinger et al. 1995; DeNicola et al. 1997; Drummond 1995; Jones and Witham 1995; Stradtman et al. 1995; Ver Steeg et al. 1995).

The controlled aspects of sharpshooting can quickly reduce deer numbers in localized areas while maximizing safety (DeNicola et al. 1997). Sharpshooting can offer deer population reduction opportunities where hunting is not allowed or is ineffective. Harvested deer are processed and donated to local food banks. Along the same lines as a controlled hunt, sharpshooting is one of the management tools recommended by the New Jersey Division of Fish and Wildlife Community-Based Deer Management Program. The program is supported by legislation passed in 2000 enabling areas of significant deer damage to be delineated as special deer management zones where alternate methods of deer control, like sharpshooting, may be employed.



Courtesy of Rutgers Cooperative Extension 2002.

Controversial topics like using sharpshooters to eliminate deer are characterized with preprogrammed disadvantages, much like regulated and controlled hunting. As part of the Community-Based Deer Management Program, implementation of sharpshooting requires approvals from municipal, county and state governments. In addition, public notification and outreach to address community concerns may postpone implementation and cost more money to account for additional time and labor spent on the project.

Costs associated with sharpshooting are usually higher than for regulated or controlled hunting, as hunters tend to pay for all their equipment themselves and generally do not have to outreach to the public. Ranging from \$88 to \$343 per deer (Frost et al. 1997; Peck and Stahl 1997), sharpshooting appears to be a cost-effective, viable method of deer control when compared with some of the other presented deer management options.

Trap and Euthanasia

Similar to trap and translocation, trap and euthanasia employs the same traps and nets to capture the deer. However, instead of relocating the deer, captured specimens are euthanized according to methods approved by the American Veterinary Medical Association. Euthanasia usually involves administering barbiturates intravenously or into the abdominal cavity, applying inhalant anesthetics, or a combination of potassium chloride and general anesthesia. A penetrating captive bolt gun or gunshot is also approved if the animal is restrained for accuracy (American Veterinary Medical Association 2001).

Trap and euthanasia management options benefit urban and suburban communities where deer numbers must be significantly reduced but logistics prevent hunting and sharpshooting (Schwartz et al. 1997). Acceptance by the public is crucial for successful implementation. When used in combination with other lethal management options, like hunting and sharpshooting, trap and euthanasia can significantly decrease deer pressure within two years (Butfiloski et al. 1997). Deer not euthanized with chemical barbiturates or anesthetic can be butchered and the venison donated to a local food bank.

Public opinion on trap and euthanasia methods are not usually supportive, and are sometimes viewed as inhumane as hunting and sharpshooting. Since considerable time could lapse between trapping and euthanasia, captured deer can die from stress-induced myopathy (Beringer et al. 1996), considered by some as an inhumane way of dying. Veterinary services would have to be contacted for euthanasia procedures, as only veterinarians have legal access to euthanasia drugs (Schwartz et al. 1997).

Compared to other deer management practices, trap and euthanasia management option may seem cost-prohibitive. Detailed costs are hard to determine, but some estimate trap and euthanasia can begin around \$300 per deer (DeNicola et al. 2000).

III. Course of Action

Primary Option

Hunting is a deer management option that even groups viewed as anti-hunting are beginning to endorse. Recent Star-Ledger articles contend that The Nature Conservancy, the Audubon Society, and the New Jersey Conservation Foundation all support the use of hunting as a viable, cost-

effective deer management option. Most agencies believe that the tight limitations applied to hunters, the only major predator of deer outside of large wilderness areas, have unfortunately resulted in forest conditions that are perfect for explosions in deer populations. Like the Natural Course management option, hunting would incur few if any costs upon Essex County (Table 1); but unlike the Natural Course option hunting can actually raise money for Essex County.

Table 1. Calculated costs of possible deer management options for South Mountain Reservation, Essex County, New Jersey.

Option	Cost (in dollars) ¹		
	minimum	maximum	
Natural Course	\$0	\$0	
Repellants	\$36,900	\$811,000	
Fencing ²	excluding labor	\$23,900	\$47,800
	including labor	\$59,700	\$89,600
Habitat Modification ³	\$1,024,000	\$2,048,000	
Trap and Translocate	\$25,900	\$705,000	
Contraception ⁴	\$50,400	\$117,000	
Hunting	regulated	\$0	\$0
	controlled	\$2,600	\$20,300
Sharpshooting	\$20,700	\$80,600	
Trap and Euthanize	\$70,500	< \$70,500	

¹ unless stated otherwise, calculations based on project area (2048 acres) and herd number (253 deer)

² calculation based on linear feet of 204.8 acres (11,948 feet)

³ calculation based on 500 acres

⁴ calculation based on 117 female deer, assuming half of eliminated herd are female

Sharpshooting can also be considered a cost-effective deer management option, but unlike hunting, requires some financial expenditure. The concept of using trained professionals to control deer populations in a controlled setting has been successfully adopted by communities such as

Millburn, Summit, and Princeton, and has been implemented in large public areas like Watchung Reservation in Morris County.

Secondary Option

Habitat modification is an unrealistic deer management option that cannot be implemented without causing extensive damage to the forest ecosystem of the Reservation. As deer can only affect the understory, large amounts of herbicides would have to be used to eliminate the palatable vegetation and replace with undesirable shrubs. In addition, the whole procedure would require great caution that invasive species do not seed into the area and dominate the understory.

Repellant use in South Mountain Reservation would be ineffective. The costs associated with applying repellants to such a large area could be too great for Essex County and surrounding communities. In addition, the high volume of residents and domestic animals that visit the area can have physiological reactions resulting from exposure to the applied chemicals either through direct contact to targeted vegetation or through aerosol material in the air.

Fencing, according to calculated costs, is an expensive deer management option. Under the assumption that a majority of the Reservation would need to be fenced to control deer migration, the sheer cost alone could be too great. A 10-foot fence can also affect the aesthetic value of the Reservation.

As secondary deer management options, however, the combination of habitat modification, fencing, and repellant use can be incorporated to address the issue of restoring the forest ecosystem within the Reservation once the immediate problem of large deer numbers is addressed through some form of hunting.

Modifying the current vegetation observed throughout the Reservation (Table 2) would require replacing it using plant species native to New Jersey (Table 3), as the Olmsted brothers stated in their annual reports to the Essex County Park Commission between 1897 and 1917. In addition, the vegetation selection process must take into account which species are resistant to deer damage, and which are available for planting from nearby nurseries. Instituting the changes would require a significantly longer time frame, and work would have to be completed on a much smaller scale than the 2048 acres that encompass the entire Reservation. Restoration efforts could be maximized over time through vegetation manipulation, fencing and repellant use to protect the modified areas, and periodic hunts to maintain deer herd numbers at manageable levels.

Table 2. Vegetation species of South Mountain Reservation, Essex County, New Jersey.

Scientific Name	Common Name	Palatability	NWI Status	Scientific Name	Common Name	Palatability	NWI Status
<u>TREES</u>							
<i>Acer platanoides</i> ¹	Norway maple	OD, FD	NI	<i>Fraxinus pennsylvanica</i>	green ash		FACW
<i>Acer rubrum</i>	red maple	RD, OD	FAC	<i>Ilex opaca</i>	American holly	RD	FACU+
<i>Acer saccharum</i>	sugar maple	OD	FACU-	<i>Liquidambar styraciflua</i>	sweet gum	RD, OD	FAC
<i>Ailanthus altissima</i>	tree-of-heaven		NI	<i>Liriodendron tulipifera</i>	tulip poplar		FACU
<i>Betula alleghaniensis</i>	yellow birch		FAC	<i>Nyssa sylvatica</i>	black gum		FAC
<i>Betula lenta</i>	black birch		FACU	<i>Pinus strobus</i>	white pine	RD, FD	FACU
<i>Betula populifolia</i>	gray birch		FAC	<i>Platanus occidentalis</i>	American sycamore		FACW-
<i>Carpinus caroliniana</i>	ironwood		FAC	<i>Prunus serotina</i>	black cherry	FD	FACU
<i>Castanea dentata</i>	American chestnut		----	<i>Quercus alba</i>	white oak	OD	FACU-
<i>Catalpa speciosa</i>	catalpa		FAC	<i>Quercus palustris</i>	pin oak		FACW
<i>Carya cordiformis</i>	bitternut hickory		----	<i>Quercus prinus</i>	chestnut oak	OD	UPL
<i>Carya glabra</i>	pignut hickory		FACU-	<i>Quercus rubra</i>	red oak	OD	FACU-
<i>Carya ovata</i>	shagbark hickory		FACU-	<i>Quercus velutina</i>	black oak		----
<i>Carya tomentosa</i>	mockernut hickory		----	<i>Robinia pseudoacacia</i>	black locust	OD	FACU-
<i>Crataegus</i> sp.	hawthorn	RD, OD, SD	----	<i>Sassafras albidum</i>	sassafras	RD, SD	FACU-
<i>Fagus grandifolia</i>	American beech	OD	FAC+	<i>Tsuga canadensis</i>	eastern hemlock	FD	FACU
<i>Fraxinus americana</i>	white ash		FACU	<i>Ulmus americana</i>	American elm		FACW-
<u>SHRUBS</u>							
<i>Alnus serrulata</i>	smooth alder		OBL	<i>Rhododendron maximum</i>	rosebay rhododendron	RD, OD	FAC
<i>Aronia arbutifolia</i>	red chokeberry		FACW	<i>Rhus coppalina</i>	winged sumac		----
<i>Berberis thunbergii</i> ¹	Japanese barberry	RD	FACU	<i>Rhus glabra</i>	smooth sumac		----
<i>Clethra alnifolia</i>	sweet pepperbush		FAC+	<i>Rosa multiflora</i> ¹	multiflora rose	OD	FACU
<i>Cornus amomum</i>	silky dogwood		FACW	<i>Rubus occidentalis</i>	black raspberry	FD	----
<i>Cornus florida</i>	flowering dogwood	RD, SD	FACU-	<i>Rubus phoenicolasius</i> ¹	wineberry		----
<i>Euonymus alata</i> ¹	winged euonymus	FD	----	<i>Rubus</i> sp.	blackberry	FD	----
<i>Hamamelis virginiana</i>	witch hazel	OD	FAC-	<i>Viburnum acerifolium</i>	mapleleaf viburnum		UPL
<i>Ilex glabra</i>	inkberry holly	RD, SD	FACW-	<i>Vaccinium angustifolium</i>	lowbush blueberry		FACU-
<i>Ilex verticillata</i>	winterberry holly	FD	FACW+	<i>Vaccinium corymbosum</i>	highbush blueberry	FD	----
<i>Kalmia latifolia</i>	mountain laurel		FACU	<i>Viburnum dentatum</i>	arrowwood		FAC
<i>Lindera benzoin</i>	spice bush	SD, FD	FACW-	<i>Viburnum lentago</i>	nannyberry		FAC
<i>Lonicera</i> sp.	honeysuckle	RD, SD	----	<i>Viburnum prunifolium</i>	blackhaw viburnum		FACU

HERBACEOUS / FERNS / GRASSES							
<i>Alliaria petiolata</i> ¹	garlic mustard		FACU-	<i>Panicum clandestinum</i>	deer tongue grass		----
<i>Allium vineale</i>	wild onion	RD	FACU-	<i>Phragmites australis</i> ¹	common reed		FACW
<i>Arisaema triphyllum</i>	jack-in-the-pulpit	RD	FACW-	<i>Poa sp.</i>	grasses		----
<i>Asclepias sp.</i>	milkweed	RD	----	<i>Podophyllum peltatum</i>	May apple	RD	FACU
<i>Athyrium filix-femina</i>	lady fern	RD	FAC	<i>Polygonum cuspidatum</i> ¹	Japanese knotweed		FACU-
<i>Boehmeria cylindrical</i>	false nettle		FACW+	<i>Polystichum acrostichoides</i>	Christmas fern	RD	FACU-
<i>Calystegia sepium</i>	hedge blindweed		NI	<i>Potentilla simplex</i>	common cinquefoil	RD	FACU-
<i>Daucus carota</i>	Queen Anne's lace		NI	<i>Solidago sp.</i>	goldenrod	RD	----
<i>Duchesnea indica</i>	indian strawberry		FACU-	<i>Sphagnum sp.</i>	moss		----
<i>Fragaria virginiana</i>	wild strawberry		FACU	<i>Streptopus amplexifolius</i>	twisted-stalk		FAC+
<i>Galium sp.</i>	bedstraw		----	<i>Symplocarpus foetidus</i>	skunk cabbage		OBL
<i>Impatiens capensis</i>	jewelweed		FACW	<i>Taraxacum officinale</i>	dandelion		FACU-
<i>Juncus effusus</i>	soft rush		FACW+	<i>Thelypteris noveboracensis</i>	New York fern	RD	FAC
<i>Juncus tenuis</i>	path rush		FAC-	<i>Trillium sessile</i>	toad trillium		NI
<i>Maianthemum canadense</i>	Canada mayflower		FAC-	<i>Trillium sp.</i>	trillium	FD	----
<i>Medicago lupulina</i>	black medic		UPL	<i>Verbascum thapsus</i>	common mullein	RD	----
<i>Microstegium vimineum</i> ¹	Japanese stiltgrass		FAC	<i>Veronica officinalis</i>	common speedwell		FACU-
<i>Onoclea sensibilis</i>	sensitive fern	RD	FACW	<i>Viola sp.</i>	violets	FD	----
<i>Osmunda cinnamomea</i>	cinnamon fern	RD	FACW	<i>Vitis sp.</i>	grape		----
<i>Oxalis stricta</i>	yellow wood-sorrel	SD	----				

VINES

<i>Parthenocissus quinquefolia</i>	Virginia creeper	RD	FACU	<i>Toxicodendron radicans</i>	poison ivy		FAC
<i>Smilax rotundifolia</i>	green briar		FAC				

¹ considered to be invasive in New Jersey

RD = rarely damaged; OD = occasionally damaged; SD = seldom damaged; FD = frequently damaged

Table 3. Possible native plant species for habitat modification, South Mountain Reservation, Essex County, New Jersey.

Scientific Name	Common Name	Palatability	NWI Status	Scientific Name	Common Name	Palatability	NWI Status
<u>TREES</u>							
<i>Acer pennsylvanicum</i>	striped maple		FACU	<i>Pinus echinata</i>	shortleaf pine		---
<i>Acer spicatum</i>	mountain maple		FACU-	<i>Pinus pungens</i>	mountain pine		---
<i>Alnus incana</i>	speckled alder		NI	<i>Pinus resinosa</i>	red pine	RD, SD	FACU
<i>Amelanchier arborea</i>	downy juneberry	RD	FAC-	<i>Pinus rigida</i>	pitch pine	RD, SD	FACU
<i>Amelanchier canadensis</i>	shadbush	RD, SD	FAC	<i>Pinus serotina</i>	pond pine		OBL
<i>Amelanchier laevis</i>	smooth juneberry	RD	---	<i>Pinus taeda</i>	loblolly pine		FAC-
<i>Amphora fruticosa</i>	indigo bush		FACW	<i>Pinus virginiana</i>	Virginia pine		---
<i>Arctostaphylos uva-ursi</i>	bearberry		NI	<i>Prunus maritima</i>	beach plum	FD	---
<i>Asimina triloba</i>	pawpaw	RD	FACU+	<i>Prunus virginiana</i>	choke cherry	FD	FACU
<i>Betula nigra</i>	river birch	RD, SD	FACW	<i>Ptelea trifoliata</i>	hoptree		FAC
<i>Betula papyrifera</i>	paper birch	RD, SD	FACU	<i>Quercus bicolor</i>	swamp white oak		FACW+
<i>Celtis occidentalis</i>	hackberry		FACU	<i>Quercus coccinea</i>	scarlet oak		---
<i>Cercis canadensis</i>	eastern redbud	OD, FD	FACU-	<i>Quercus falcata</i>	southern red pine		FACU-
<i>Chamaecyparis thyoides</i>	Atlantic white cedar	OD, FD	OBL	<i>Quercus ilicifolia</i>	bear oak		---
<i>Chionanthus virginicus</i>	fringetree	OD, FD	FAC+	<i>Quercus marilandica</i>	blackjack oak		---
<i>Cornus alternifolia</i>	alternate-leaf dogwood		---	<i>Quercus phellos</i>	willow oak		FAC+
<i>Diospyros virginiana</i>	persimmon		FAC-	<i>Quercus stellata</i>	post oak		UPL
<i>Juniperus virginiana</i>	red cedar		FACU	<i>Rhus aromatica</i>	aromatic sumac		---
<i>Larix laricina</i>	eastern larch	OD	FACW	<i>Salix nigra</i>	black willow	OD	FACW+
<i>Magnolia virginiana</i>	sweetbay magnolia	RD, SD	FACW+	<i>Tilia americana</i>	American basswood	OD	FACU
<i>Ostrya virginiana</i>	hophornbeam		FACU-	<i>Ulmus rubra</i>	slippery elm		FAC
<i>Oxydendrum arboreum</i>	sourwood		NI	<i>Vaccinium macrocarpon</i>	cranberry	RD, SD	OBL
<i>Picea mariana</i>	black spruce	RD, SD	FACW-	<i>Viburnum nudum</i>	possumhaw		OBL
<i>Picea rubens</i>	red spruce	RD, SD	FACU	<i>Zanthoxylum americanum</i>	prickly ash		---
<u>SHRUBS</u>							
<i>Aronia melanocarpa</i>	black chokecherry		FAC	<i>Ilex laevigata</i>	smooth winterberry		OBL
<i>Aronia prunifolia</i>	purple chokeberry		FACW	<i>Itea virginica</i>	Virginia sweetspire		FACW
<i>Baccharis halimifolia</i>	groundsel bush		OBL	<i>Iva frutescens</i>	marsh elder		FACW-
<i>Ceanothus americanus</i>	New Jersey tea		FAC	<i>Kalmia angustifolia</i>	sheep laurel		FAC+
<i>Cephalanthus occidentalis</i>	buttonbush		---	<i>Lyonia ligustrina</i>	maleberry		FACW
<i>Clematis virginiana</i>	virgin's bower	FD	---	<i>Lyonia mariana</i>	staggebush		FAC
<i>Comptonia peregrina</i>	sweet fern		---	<i>Myrica cerifera</i>	wax myrtle		FACW
<i>Corema conradii</i>	broom crowberry		FACW+	<i>Myrica pennsylvanica</i>	northern bayberry	RD, SD	FAC
<i>Cornus racemosa</i>	gray dogwood	OD	FACU-	<i>Physocarpus opulifolius</i>	common ninebark		FAC-
<i>Cornus rugosa</i>	round-leaved dogwood		FACU-	<i>Rhododendron periclymenoides</i>	pinxterbloom azalea	OD, FD	---
<i>Cornus stolonifera</i>	red osier dogwood	RD, SD	FAC	<i>Rhododendron viscosum</i>	swamp azalea		FAC
<i>Corylus americana</i>	American hazelnut		FAC	<i>Rosa palustris</i>	swamp rose		OBL
<i>Corylus cornuta</i>	beaked hazelnut		FACW	<i>Salix discolor</i>	pussy willow	OD	OBL
<i>Eubotrys racemosa</i>	fetterbush		FAC	<i>Sambucus canadensis</i>	elderberry	RD	FACW

<i>Euonymus americanus</i>	American strawberry bush	FACW-	<i>Spirea latifolia</i>	meadowsweet	SD	---
<i>Gaylussaccia baccata</i>	black huckleberry	FAC	<i>Spirea tomentosa</i>	steeplebush	SD	---
<i>Gaylussaccia frondosa</i>	dangleberry	OBL	<i>Staphylea trifolia</i>	American bladdernut		FACW+
			<i>Viburnum cassinoides</i>	witherod		FAC

RD = rarely damaged; OD = occasionally damaged; SD = seldom damaged; FD = frequently damaged

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