

BAILEY BROOK WATERSHED PLAN PRELIMINARY INVESTIGATION

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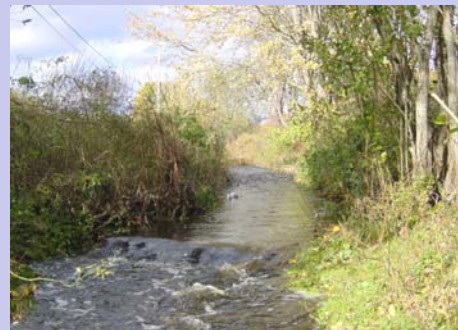


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EXECUTIVE SUMMARY

The United States Department of Agriculture-Natural Resources Conservation Service (NRCS) selected GeoSyntec Consultants (GeoSyntec) to conduct a preliminary assessment of the Bailey Brook watershed, located in Middletown and Newport, Rhode Island.

The highly urbanized Bailey Brook watershed has been ranked as having the highest water quality risk of the eight subwatersheds that comprise the Aquidneck Island Reservoir watersheds complex (URI, 2003). Through this Preliminary Watershed Assessment, GeoSyntec provided the NRCS with a comprehensive compilation, field assessment, and analysis of data related to water quality protection in this watershed, which includes the primary water supply reservoir for Newport Water's Station 1 distribution system.

GeoSyntec conducted a variety of investigations and assessments that were organized into the following four tasks:

<p>TASK 1: Assessment of Development Encroachment in Watershed Protection Zones</p>	<ul style="list-style-type: none"> ▪ Reviewed existing reports, data and maps related to Bailey Brook watershed land use and development. Created new GIS maps for the watershed. ▪ Reviewed the SWAP report for the Newport Water and Stone Bridge Fire District and identified issues related to watershed development. Summarized: (1) the 1986 Aquidneck Island Watershed Protection Project, Final Watershed Plan; and (2) the 1993 Nonpoint Source Management Plan for Newport Surface Water Supply Watersheds. ▪ Reviewed local regulations that affect watershed protection. Improved ordinances and other related steps were recommended to improve coordination and enforcement efforts.
<p>TASK 2: Flood Prevention Assessment</p>	<ul style="list-style-type: none"> ▪ Conducted an assessment of flooding along Bailey Brook and its tributaries, including: (1) a review of available literature; (2) a detailed on-site survey of the stream system; and (3) interviews with town officials and local residents.
<p>TASK 3: Assessment of Agricultural and Non-Agricultural Water Management Issues</p>	<ul style="list-style-type: none"> ▪ Conducted an inventory, GIS analysis and site investigation of agriculture in the watershed. Provided: (1) an updated assessment of agriculture in the watershed; and (2) an assessment of nonpoint source pollution issues from active agricultural sites, including recommendations related to mitigation. ▪ Reviewed documents related to non-agricultural water management issues in the watershed, including residential/commercial development. Conducted site investigations to identify potential mitigation alternatives. ▪ Information related to GeoSyntec's investigations of agricultural and non-agricultural issues are included in the GIS maps provided in this section.
<p>TASK 4: Stream Assessment Surveys</p>	<ul style="list-style-type: none"> ▪ Conducted surveys of Order 1 streams in the watershed using the Unified Stream Assessment (USA) method. Data was collected on locations, conditions, and restorability of problems identified. ▪ Performed a habitat assessment survey of five reaches of the Bailey Brook mainstem, using the Rapid Bioassessment Protocol (RBP). The habitat assessments included water quality monitoring and a systematic assessment of in-stream and riparian physical structure. The surveys were used to identify problems and restoration opportunities along the Bailey Brook mainstem. ▪ Developed GIS-based maps to present information related to the data collected for the USA stream assessments and RBP habitat assessments.

A brief summary of the primary recommendations and conclusions of this preliminary watershed investigation are as follows, presented according to task.

TASK 1: ASSESSMENT OF DEVELOPMENT ENCROACHMENT IN WATERSHED PROTECTION ZONES

Task 1 involved review and assessment of existing reports, local regulations, maps and other data sources relevant development in the Bailey Brook watershed. An overview of key points and GeoSyntec's analysis is as follows:

- Of the eight subwatersheds that comprise the Newport Water/Stone Bridge Fire District, the Bailey Brook watershed was determined by the 2003 Source Water Assessment Program (SWAP) report to have the highest intensity land use and was also placed in the "extreme risk" category for water quality. However, GeoSyntec's analysis found that the SWAP report overestimated several key water quality risk factors related to land use:
 - The recent conversion of the Boulevard Nursery to protected open space is a notable reduction in high-intensity land use in the watershed.
 - The SWAP report estimated that "high-intensity" land uses comprise over 50% of the 200-foot riparian zone in the watershed. GeoSyntec's updated orthophoto analysis estimated that 34% of the riparian zone had high intensity land uses.
 - The SWAP report estimated that impervious surfaces cover 35% of the watershed (based on 1997 land use data). GeoSyntec's analysis, based on 2004 IKONOS satellite imagery, estimated 24% imperviousness.
- Approximately 98% of the watershed is characterized by hydrologic group "C" soils, which are slowly permeable and have a hardpan layer that restricts infiltration. Site-specific soil investigations are necessary for design of stormwater management practices.
- As part of Task 1, GeoSyntec provided a list of recommendations for potential amendments to specific Town of Middletown regulatory documents (see page 1-14). Although the Bailey Brook watershed is the focus of this regulatory assessment, most of the regulatory recommendations provided in this section are equally relevant to other parts of Middletown and Aquidneck Island.
- Middletown should develop an updated "best development practices" local guidance manual that provides information on low-impact development practices which mimic pre-development site hydrology and protect water quality.
- GeoSyntec assessed Middletown's National Pollutant Discharge Elimination System (NPDES) Phase II Stormwater Management Plan and developed a list of "High Priority" action items from the Plan (see page 1-12).

TASK 2: FLOOD PREVENTION ASSESSMENT

A stream gauge should be installed immediately upstream of Forest Avenue in Bailey Brook. Data from this gauge and corresponding flow velocity/discharge measurements will allow for development of a stage-discharge relationship at this location, which in turn will aid evaluation of upstream and downstream flow conditions.

A more detailed investigation of flooding conditions is warranted at the following locations: (1) north and south of the Bailey Brook crossing at Valley Road; (2) the Bailey Brook crossing at Miantonomi Avenue; and (3) the Tributary 2 crossing at Oliphant Lane/Jepson Lane. Documentation of flow conditions during large precipitation events will improve understanding of the extent of flooding conditions and appropriate mitigation actions.

Development of a hydraulic/hydrologic analysis of the Bailey Brook system is recommended, utilizing continuous simulation models. Detailed information on stream dimensions, stage-discharge

relationships and localized rainfall-runoff relationships at critical reaches along the Brook and its tributaries could yield predictive models for water surface profiles under expected precipitation conditions. Models could also be used to evaluate the impact of various mitigation options.

TASK 3: ASSESSMENT OF AGRICULTURAL AND NON-AGRICULTURAL WATER MANAGEMENT ISSUES

- 1995 RIGIS land use data identifies 389.5 acres in the Bailey Brook watershed as agricultural or pasture land. Based on GeoSyntec's assessment, only 32% of the agricultural/pasture lands identified by RIGIS are being actively used for agriculture. Rhode Island Nursery (126 acres) is the only significant agricultural operation that is active in the Bailey Brook watershed. This property appeared well-maintained, with no signs of erosion or significant sediment transport/deposition related to stormwater runoff.
- NRCS is developing a plan with Rhode Island Nursery to install a "vegetative field border buffer zone". The buffer zone would intercept runoff from the fields before they could reach Tributary #3. Given that: (1) this property is the only significant agricultural operation in the watershed; and (2) trizene is a documented contaminant of concern in Bailey Brook and North/South Easton Pond, implementing this project should be a priority.
- GeoSyntec assessed a variety of non-agricultural sites to provide stormwater mitigation recommendations that were site-specific, but could also be applied to similar sites throughout the watershed. These sites included the Aquidneck Centre shopping area, the Gaudet Middle School, Valley View subdivision, Wood Road/Wood Terrace, and the office building complex at 333 Valley Road. Recommended practices included bioretention cells, porous pavers, pre-cast trench drains, vegetated water quality swales, deep sump catch basins, and raingardens.
- In addition to the stormwater management issues discussed above, GeoSyntec identified several sites requiring regulatory action or additional investigation:
 - **Skater Island and 465 Oliphant Lane:** At both of these sites, GeoSyntec noted erosion from large, unprotected earthen piles adjacent to wetlands. Erosion controls should be placed between the perimeter of the site and wetlands. Stockpiles should either be stabilized with erosion controls or vegetated.
 - **Potential Sewer Pipe Leaks:** GeoSyntec noted potential sewer pipe leaks at three sites: (1) Wood Terrace; (2) north of Miantonomi Avenue; and (3) above the sewer main behind Middletown Square shopping area. GeoSyntec notified Middletown and Rhode Island Department of Health officials of the potential leaks.
 - **Forest Park/Airport Access Road Area:** GeoSyntec staff observed strong odors (rotten egg/sulphur) and a flocculent orange/opaque film covering the channel bottom where an intermittent channel flows into Tributary 3. A home owner reported similar conditions and an unspecified orange substance periodically flowing in a downstream area adjacent to nearby Bluegrass Drive. Additional investigation is recommended.
 - **Potential Development Sites:** GeoSyntec identified two potential development sites adjacent to Bailey Brook. These sites (as of 12/04) were advertised "for sale or lease". One site (approximately 5 acres) is just east of where the Brook crosses Valley Road. The other (1.6 acres) is 1000 feet east of the Brook, just south of the intersection of E. Main and Valley Road. These sites are zoned for commercial/industrial use.

TASK 4: STREAM ASSESSMENT SURVEYS

GeoSyntec conducted surveys of Order 1 streams in the watershed using the Unified Stream Assessment (USA) method. Data was collected on locations, conditions, and restorability of problems. An overview of the survey results is provided below.

Tributary	Water Quality Issues/Threats	USA Reach Assessment*		
		In-stream	Buffer/ Floodplain	Total
Upper Bailey Brook				
Reach 1	<ul style="list-style-type: none"> ▪ No significant problems identified. 	68	60	128
Reach 2	<ul style="list-style-type: none"> ▪ Sewer main adjacent to (and crosses) stream. ▪ A portion of Reach 2 has been widened and relocated. ▪ Large piles of unprotected fill are actively eroding in "Skater Island" area adjacent to wetland at stream headwaters. ▪ Sediment deposition in stream channel. 	54	46	100
Tributary #1				
Reach 1	<ul style="list-style-type: none"> ▪ Stable wetland channel. No problem areas identified. 	77	68	145
Reach 2	<ul style="list-style-type: none"> ▪ Moderate sediment deposition. No significant problems observed. 	50	53	103
Reach 3	<ul style="list-style-type: none"> ▪ Possible illegal floor drain connection requiring further investigation. ▪ Area of inadequate vegetated buffer (mowed lawn adjacent to stream). 	63	51	114
Tributary #2				
Reach 1	<ul style="list-style-type: none"> ▪ Small, stable wetland channel. No problem areas noted. 	74	67	141
Reach 2	<ul style="list-style-type: none"> ▪ Moderate channel erosion, bank scour, sediment deposition. Stream is deeply entrenched. ▪ Marginal buffer zone (10'-25'), with significant floodplain encroachment from adjacent development. 	28	18	46
Reach 3	<ul style="list-style-type: none"> ▪ Reach 3 appears to have been widened and relocated. 	58	69	127
Tributary #3				
Reach 1	<ul style="list-style-type: none"> ▪ Downstream section of Reach 1 was altered (widened, bank alteration) with a bulldozer to increase storage capacity. ▪ Inadequate buffer (mowed law to stream edge) along Champlin Terrace. ▪ Odor (sulphur/rotten egg) and orange film at several in-stream locations. 	63	61	124
Reach 2	<ul style="list-style-type: none"> ▪ Odor (sulphur/rotten egg) and orange film at several in-stream locations. ▪ Odor and buildup of highly flocculent material in channel, at confluence with drainage ditch (<i>additional investigation recommended</i>). ▪ Piles of unprotected fill are eroding from property of H. Lacerda Jr. Landscaping & Construction, adjacent to wetland at stream headwaters. 	47	26	73
Tributary #4				
Reach 1	<ul style="list-style-type: none"> ▪ In general, Reach 1 is stable and has extensive vegetated buffers. ▪ Minor area of inadequate buffer (mowed grass to stream edge) and rip-rap bank stabilization just downstream of Valley Road. 	68	65	133
Reach 2	<ul style="list-style-type: none"> ▪ Small area of bank scour and channel erosion upstream of Valley Rd. ▪ Piles of debris (stone, logs, gravel) in stream at area adjacent to sand/gravel operation off of Aquidneck Avenue. Significant sediment deposits found downstream of this area. ▪ Headwaters pond off Aquidneck Ave. is filling with sediment and should be excavated to provide additional stormwater storage capacity. 	51	43	94

* USA score based on a maximum total of 160 points (80 in-stream, 80 buffer/floodplain), which represents the highest quality stream conditions for this region.

GeoSyntec performed a habitat assessment survey of five reaches of the Bailey Brook mainstem, using the Rapid Bioassessment Protocol (RBP). An overview of the survey results is provided below.

Bailey Brook RBP Reaches	Reach Location
Reach 1	North Easton Pond inlet (Miantonomi Ave.) to East Main Rd.
Reach 2	East Main Rd. to Valley Rd.
Reach 3	Valley Rd. to Forest Ave.
Reach 4	Forest Ave. to Oliphant Lane
Reach 5	Oliphant Lane to headwaters (west of Amesbury Circle).

RBP Habitat Assessment Summary Table

HABITAT PARAMETER	BAILEY BROOK RBP ASSESSMENT REACH - SCORES*				
	REACH 1	REACH 2	REACH 3	REACH 4	REACH 5
1. Epifaunal Substrate/ Available Cover	6	18	18	13	8
2. Pool Substrate Characterization	8	10	18	15	15
3. Pool Variability	2	5	7	4	3
4. Sediment Deposition	11	20	20	19	19
5. Channel Flow Status	18	20	19	20	19
6. Channel Alteration	18	20	20	19	14
7. Channel Sinuosity	8	6	10	12	7
8. Bank Stability	18	20	20	20	20
9. Vegetative Protection	18	18	18	18	16
10. Riparian Vegetative Zone Width	20	12	18	20	18
TOTAL SCORE	127	149	168	160	139

* The RBP Habitat Assessment Total Score is based on a maximum total of 200 points (higher scores indicates relatively better habitat conditions, lower scores indicate worse). The scores listed above should be viewed only as a *relative measure* of stream habitat conditions, and within the limited context of the project scope of work. The RBP protocols advocate the comparison of habitat conditions (e.g., physical structure, flow regime), water quality and biological measures with empirically defined **reference conditions** that represent the natural range of variation in "minimally" disturbed water chemistry, habitat, and biological conditions of comparable streams. Although reference conditions were not established as part of this project, the assessment data provided can be used as a valuable point of comparison if reference conditions are established as part of a future project.