NGI

NORTHEAST GEOSCIENCE, INC.

WATER RESOURCES IMPACT EVALUATION REPORT

EVERGREEN COMMONS, LLC

NEWBURYPORT, MASSACHUSETTS

SEPTEMBER, 2016

WATER SUPPLY AND ENVIRONMENTAL SERVICES

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NGI PROJECT NO. 160801

QUALITY ASSURANCE/QUALITY CONTROL

The following personnel have reviewed this report for accuracy, content and quality of presentation:

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Date

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Date

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1.0 Introduction

Evergreen Commons, LLC is proposing construction of a 38 lot Open Space Residential Development (OSRD) on a 36.4 acre parcel of land in the City of Newburyport, Massachusetts (See Figure 1 for Site Location). The site is currently developed as a nine hole public golf course known as the Evergreen Valley Golf Course (Figure 2 – Existing Conditions Site Plan). The golf course has been identified as a potential source of contamination to Newburyport Wells No. 1 and No. 2. The proposed OSRD will replace the golf course with a cluster type housing development including 38 residential units served by City water and sewer services (Figure 3 – Proposed Conditions Site Plan). The proposed OSRD will eliminate the golf course as a potential source of contamination to the wells.

The proposed development is located in the Zone II Recharge Area for the City of Newburyport Well No. 2 located off Ferry Road in Newburyport, MA (see Figure 1 for well location). Well No. 2 is a gravel packed well installed in 1958 and currently supplies approximately 10% of the City of Newburyport Public Water Supply. Concerns have been raised regarding the potential impact of the proposed OSRD on the yield and water quality characteristics of Well No. 2. The purpose of this report is to evaluate the potential impacts of the proposed development on Well No. 2.

2.0 Site Description

The site of the proposed OSRD is a 36.4 acre parcel located at 18 Boyd Drive in Newburyport, MA. The site is located in the Merrimack River Basin approximately ½ mile south of the river and five miles west of the location where the Merrimack River discharges to the Atlantic Ocean.

Currently the property is the site of the Evergreen Valley Golf Course, a nine hole public golf course that has been operated at this location since 1984. There are two 6-inch diameter irrigation wells that are screened in deposits of sand and gravel and discharge to an on-site clay lined irrigation pond to store water for golf course irrigation. These wells withdraw approximately 60,000 gallons per day (gpd) during the irrigation season. Prior to construction of the golf course, the property was known as Vitale's Pit and was mined for sand and gravel.

The property is bounded on the west by Interstate I-95, to the north by a residential subdivision including Briggs Avenue, Brown Avenue, Fenders Avenue, Azalea Road and Laurel Road, to the northeast by a City Owned parcel including Well No. 2, to the southeast by a residential subdivision on Boyd Drive.

The topography of the site is characterized by low relief (relatively flat land) in the central portion of the site and higher elevations around the edges of the former sand and gravel quarry. There are two clay lined ponds in the central portion of the site that receive stormwater from Boyd Avenue and drain to the north toward and isolated land subject to flooding where collected water infiltrates back into the subsurface. There is no external drainage from the site. There have been reports of flooding in the northern portions of the property following large rain events.

3.0 Literature Review and Meeting with City Representatives

NGI has reviewed reports prepared by the United States Geological Survey (USGS) on the geology and hydrology of the site, reports by BSC Engineering (1984) and Lally Associates (1985) prepared during the proposed development of the Evergreen Golf Course and Boyd Drive subdivision, and a report by Talkington Edson Environmental Management (TEEM, 1999) prepared to document the delineation of the Zone II Recharge Area for Newburyport Wells No. 1 and No. 2. A list of the references reviewed is included at the end of this document. NGI met with representatives of the City of Newburyport including the Mayor, the Director of Public Services, the City Engineer, the Director of Planning, the Water Superintendent, Water System Operators and the City's Engineering Consultant to discuss the status, operation and maintenance of Well No. 2 and the other sources of water in the Newburyport Public Water System.

4.0 Field Investigation

NGI has conducted field reconnaissance of the site and the Zone II Recharge Area of Wells No. 1 and No. 2 to evaluate current land use and site geology and hydrogeology. In addition a subsurface investigation was conducted to collect information on unconsolidated soil deposits on site, bedrock surface elevations, groundwater elevations and groundwater flow directions on site. Technical Drilling Services (TDS) of Sterling, MA was contracted to install eight soil borings using a hollow stem auger drilling rig. Standard soil penetration tests were conducted at five foot intervals in each boring and samples were collected using a 24-inch long split spoon sampler. Soil samples were characterized in the field by a geologist at the time they were collected. In seven of the boring locations, 2-inch diameter PVC monitoring wells with 0.010-inch slot size PVC well screens were installed. Monitoring well and boring locations are shown on Figure 2 and logs of the wells and borings are included in Appendix A.

The results of the subsurface investigation indicate that the site is underlain by deposits of stratified silt, sand and gravel to depths ranging from a minimum of 12 feet at boring SB-4 (drilling refusal) to at least 25 feet in remaining borings. The remaining borings were

terminated at either 20 or 25 feet and no other drilling refusals were encountered. Monitoring wells constructed in seven borings were developed using a gasoline powered centrifugal pump to remove sediment, and each well was hydraulically tested to ensure representative water level data could be collected from the wells. The wells were surveyed for location and elevation to the nearest tenth of a foot to a reference point on the top of each well casing by Winter GEC, LLC. Water level data were collected on September 16, 2016 and these data were used to develop the groundwater a contour map and to estimate groundwater flow directions.

5.0 Site Geology and Hydrogeology

The surficial geology of the site was mapped most recently in 2006 by Stone et al. (see Figure 4 – Surficial Geologic Map). Stone mapped these materials as glacial outwash and ice contact deposits of Pleistocene Age. These deposits are described as thick stratified deposits of sand, gravel and cobbles with relatively high permeability. Field reconnaissance and the subsurface investigation conducted by NGI confirmed the presence of these deposits to depths of at least 25 feet. Newburyport Well No. 2 is constructed in, and derives water from, these deposits and was installed to a depth of 52.8 feet.

Talkington Edson Environmental Management (TEEM) delineated the Zone II Recharge Area of Wells No. 1 and No. 2 in 1999 as part of a Source Water Assessment Grant issued by the US Environmental Protection Agency (EPA). The Zone II Recharge Area is defined as the area of an aquifer that contributes water to a well under the most severe pumping conditions that can realistically be anticipated (180 days of pumping at the maximum approved pumping rate with no recharge from precipitation). TEEM delineated a combined Zone II Recharge Area for Wells No. 1 and No. 2 which is roughly bisected by I-95 and is shown on Figure 5. Figure 6 is a map showing existing land uses within the Zone II Recharge Area. As part of the Zone II Recharge Area study, TEEM (1999) analyzed data from pumping tests conducted on Well No. 2 and test wells installed in the vicinity of Well No. 2. Analysis of data by TEEM generated in estimates of aquifer transmissivity of approximately 59,700 gallons per day per foot (gpd/ft) in the vicinity of Well No. 2. These values indicate high permeability deposits capable of readily transmitting groundwater as indicated by the high yield of Well No. 2.

BSC Engineering installed 12 groundwater monitoring wells on the site in 1984 as part of a subsurface investigation of the site. Based on this investigation they developed a groundwater contour map of the site showing lines of equal groundwater elevation and interpretations of groundwater flow directions (see Figure 7).

NGI installed seven groundwater monitoring wells in 2016. In addition NGI identified seven existing monitoring wells and two irrigation wells on and adjacent to the site that were surveyed and monitored. Water level elevation data from these locations were used to

develop the groundwater contour map presented on Figure 8. Both BSC and NGI identified a bedrock high in the northeastern portion of the Evergreen Commons Property, which forms a hydraulic boundary to flow of Well No. 2. The groundwater elevations, hydraulic gradients and groundwater flow directions interpreted by NGI are consistent with the information developed by BSC Engineering.

Groundwater flow is to the north toward the Merrimack River and northeast toward Well No. 2 at a hydraulic gradient of approximately 0.002 (0.2% slope). The flow system diverges around the bedrock high identified by BSC Engineering and confirmed by NGI. To the west of this feature, flow is to the north toward the Merrimack River. To the east of the bedrock high groundwater flow is to the east toward Well No. 2. Based on this analysis approximately 50% of the site has groundwater flow directions toward Well No. 2.

6.0 Newburyport Public Water System

The Newburyport Water Works was established in 1908 to supply water to the City of Newburyport and several other communities. Sources of water include three surface water sources (the Artichoke Reservoir, Bartlett Spring Pond and the Indian Hill Reservoir) and two groundwater sources (Well No. 1 and Well No. 2) located off Ferry Road. The water system has a Water Management Act Registration of 2.2 million gallons per day (MGD) and a Water Management Act Permit for 0.29 MGD for a total authorized system withdrawal of 2.49 MGD. According to the 2015 Annual Statistical Report the system withdrew a daily average of 1.89 MGD.

Wells No. 1 and No. 2 are registered sources under the Water Management Act and are included in the 2.2 MGD registered volume. TEEM (1999) lists the approved yield of Well No. 1 as 325 gpm or 0.486 MGD and the approved yield of Well No. 2 as 408 gpm or 0.587 MGD. The Zone II Recharge Area for Wells No. 1 and No. 2 is a combined Zone II for the two sources calculated at the flow rates indicated above and is approximately 238.5 acres (note that the TEEM report states that the Zone II is 313 acres but analysis of the MassGIS shape file for the Zone II indicates 238.5 acres). According to the Newburyport Department of Public Services, Well No. 1 operates at approximately 200 gpm (0.3 MGD) and Well No. 2 operates at approximately 225 gpm (0.32 MGD). During the summer months the wells operate most, if not all of the time at these rates. Well No. 2 is chemically treated for pH and alkalinity adjustment at the well using sodium hydroxide and pumped directly into the distribution system with a vertical turbine pump.

7.0 Well No. 2 Water Quality

According to TEEM (1999) and the Newburyport Department of Public Services, the quality of the water derived from Well No. 2 is excellent. Review of the City of Newburyport Consumer Confidence Reports for 2014 and 2015 indicates that no volatile organic contaminants (VOCs) or synthetic organic contaminants (SOCs) have been detected in samples from Wells No. 1 and No. 2. NGI reviewed the Massachusetts Department of Environmental Protection (MADEP) water quality data base for nitrate and sodium concentration data for water samples from Well No. 2. Nitrate is a component of fertilizer and the concentration of nitrate in water from Well No. 2 is an indicator of water quality impacts from turf management and residential lawn care practices. Sodium is a component of highway and roadway de-icing products and the concentration of sodium in the water from Well No. 2 is an indicator of road salt impacts. The data from the MADEP data base are presented on Table 2 and a graph of the data is presented on Figure 9.

As can be seen from Figure 9 nitrate concentrations in Well No. 2 increase from the start of the data set in 1993 until January 2004 when the concentration peaks at 2.1 mg/L. Since that date concentrations have decreased to approximately 1.7 mg/L. These values are significantly below the MCL for nitrate of 10 mg/L.

The sodium concentration data from Well No. 2 show a similar trend. Concentrations increase from the start of the data set in 1993 until they peak in March of 2003 at 51 mg/L. Since that date concentrations have decreased to approximately 27 mg/L or approximately 11% of the secondary drinking water standard of 250 mg/L for sodium. It is not clear what is driving these concentration trends, however, both data sets indicate that turf/lawn care practices and road maintenance practices are not resulting in increasing trends in these parameters over the last 10 years. The sodium trend could be a result of better salt management practices by the City.

8.0 Current Land Use in Zone II and at the Site

Figure 6 is a map showing existing land uses in the Zone II Recharge Area for Wells No. 1 and No. 2. According to MassGIS, the Zone II is currently 47% forest, 18% residential, 13% golf course, 10% transportation, 10% agricultural and 1% water supply protection land.

As part of the Source Water Assessment conducted by TEEM (1999) potential contamination sources within the Zone II Recharge Areas of the wells were required to be identified. TEEM identified the Evergreen Valley Golf Course, I-95, St. Mary's Cemetery and gravel pits off Ferry Road as potential contamination sources to the wells. Existing residential development on

Briggs Avenue, Brown Avenue, Fenders Avenue, Azalea Road Laurel Road and Boyd Drive comprise 18% of the Zone II Recharge Area, but were not listed as potential contamination sources by TEEM.

The Evergreen Valley Golf Course was listed as a potential contamination source with a moderate threat ranking as a result of turf management practices and on site storage of fertilizers pesticides, herbicides, fungicides and other turf management products. The golf course club house and facilities are served by City water and sewer services. There are two 6-inch diameter irrigation wells that pump water to an on-site irrigation pond. The golf course operator estimates that these wells operate approximately ten hours per day and pump a combined rate of 100 gpm (60,000 gallons per day) during the irrigation season (May through September). Irrigation is applied mainly to greens and tees and to a limited extent on fairways.

Fertilizer and other turf management products including herbicides, fungicides and pesticides are applied to tees, greens and fairways as required. The total parcel is 36.4 acres, our of which 7.1 acres is wetlands or isolated land subject to flooding and 5.5 acres is unmaintained perimeter areas. This leaves approximately 23.8 acres of maintained turf on the existing course.

Under existing conditions there is no maintained roadway on the parcel. There is a parking lot, but NGI has assumed that this parking area is not maintained in the winter due to the seasonal nature of the business. Vehicular traffic on the golf course is limited to seven gasoline powered golf carts, ten electric powered golf carts and a combination of gasoline and diesel powered mowers.

Current stormwater management on site is limited. Two clay lined ponds in the central portion of the site receives stormwater from the parking are and Boyd Drive through on existing 24-inch diameter RCP pipe. Runoff from Boyd Drive and the rest of the course is all directed to the existing ponds which lead to the isolated land subject to flooding where the water infiltrates. There is no off site drainage.

9.0 Proposed Land Use at the Site

The proposed land use at the site is a 38 lot OSRD with 38 single family housing units with an average lot size of 0.31 acres or a total of 11.78 acres of lot area. The proposed development will include approximately 1.4 acres of road and 0.6 acres of driveway for a total of 2.0 acres of pavement. The average residential unit in the project will have a 2,400 square foot roof for a total of 2.1 acres of impervious roof area. Assuming that each lot is maintained lawn area with the exception of the driveways and roof areas there could be up to approximately 9.1 acres of

maintained turf under post development conditions. This is approximately 62% less maintained turf area than under existing conditions.

Stormwater from proposed roadways will be managed using Low Impact Design techniques in accordance with the Massachusetts Stormwater Handbook. The clean stormwater runoff from the roofs of the new homes will be directed to underground infiltration chambers where it will be infiltrated back into the ground. Drainage from paved areas will be directed rain gardens and surface infiltration systems. These systems will be landscaped and visually appealing. Any paved surface runoff directed to infiltration areas will have a minimum of the 44% total suspended solids removal pretreatment as required in the DEP Stormwater Standards. These systems will be maintained by the new homeowners association with no maintenance responsibility to the Newburyport Department of Public Services.

The total volume of aquifer recharge under post development conditions is not anticipated to be different than recharge volumes under existing conditions. Termination of irrigation withdrawals at the golf course will result in increased available yield to Well No. 2 under post development conditions.

10.0 Existing Wellhead Protection Measures

In July, 1998 the City of Newburyport adopted a Water Resource Protection District Zoning Ordinance in the City. The purpose of the Water resources Protection District Ordinance is to restrict land use within the Zone II Recharge Areas to the City Wells and the Zone A Recharge Areas to the City Surface Water Supplies to protect the quantity and quality of water derived from the wells. The By-law was developed using the MADEP Model Zoning Ordinance and MADEP has acknowledged that Newburyport's By-law complies with wellhead protection measures outlined in the drinking water regulations (310 CMR 22.000).

The ordinance prohibits citing of landfills, junk yards, retail gas stations, truck terminals, bulk petroleum storage facilities and other land uses in the Water Resources Protection District. The proposed Evergreen Commons OSRD is a permitted use within the Water Resource Protection District.

Concerns have been raised by representatives of the City of Newburyport and abutting property owners about potential contamination of Well No. 2 by activities of the future owners of the proposed houses in the OSRD. Specifically concerns about over application of lawn care products, accidental releases of gasoline or other petroleum products or intentional dumping of waste oil or other waste products. While it is not possible to rule these threats out entirely, experienced wellhead protection specialists at the United States Environmental Protection

Agency (EPA) and MADEP have not specifically identified typical residential land use, particularly when residences are served by City sewer, as a significant threat to groundwater quality. As such, residential land uses are allowed in Zone II and the Water Resources Protection District because extensive experience evaluating wellhead protection has not identified discharges on residential properties as a common source of groundwater contamination.

Currently, 18% of the Zone II Recharge Area for the wells is residential development and has been since at least the mid 1980's. The existing developments on Briggs Avenue, Boyd Drive and Ferry Road are within 360 to 400 feet of Well No. 2. There is no evidence that the existing residential development and associated land uses in Zone II have resulted in water quality problems at Well No. 2. The proposed Evergreen Commons OSRD is similar in nature to the existing residential developments, except lot and lawn sizes are proposed to be smaller and the nearest lot is over 720 feet from Well No. 2.

Another concern raised was the impact of road salt applications in the Evergreen Commons OSRD on the quality of water derived from Well No. 2. NGI evaluated existing roadways in Zone II from I-95 to the east (the portion of the combined Zone II interpreted to contribute water to Well No. 2). Table 3 presents estimates of existing roadways in the eastern half of the combined Zone II including the east side of I-95 and other existing roads. NGI estimates that there is approximately 16.3 acres of existing road in the eastern half of Zone II. The proposed development includes approximately 1.4 acres of road and will represent an 8% increase in the amount of road in the eastern half of Zone II.

It seems reasonable to expect an 8% increase in sodium concentrations in Well No. 2 after long term road salt impacts are realized (10 years or more). The average sodium concentration in Well No. 2 from 1993 to 2016 was 26.6 mg/L. The Evergreen Commons OSRD will likely increase the average concentration to 28.7 mg/L after the concentrations stabilize over the next 10 to 20 years. At present there are no health based drinking water standards for sodium. EPA has established a secondary standard of 250 mg/L for sodium based on aesthetic concerns (ie: salty taste). At this time the projected sodium concentrations at Well No. 2 under post development conditions are far below the secondary drinking water standard of 250 mg/L.

11.0 Future Expansion or Relocation of Well No. 2

Representatives of the City of Newburyport have raised questions regarding the impact of the proposed OSRD on the ability of the City to expand or replace Well No. 2. MADEP requires that replacement wells maintain or improve wellhead protection aspects of well placement and specifically focus on the Zone I 400 foot protective radius now required around wells that produce more than 100,000 gpd.

Currently Well No. 2 is 720 feet from the Evergreen Valley Golf Course property line and proposed OSRD, 380 feet from residences on Briggs Avenue, 420 feet from residences on Boyd Drive and 310 feet off Ferry Road. A replacement well could potentially be located as much as 300 feet west of the current location and maintain compliance with the Zone I requirement. Such a location would have to be identified and test through a test well exploration program and approved by MADEP for further development.

Expansion of the withdrawals from Well No. 2 would require more extensive permitting including a modification to the Water Management Act Permit for the City to include the new well, re-delineation of Zone II and extensive environmental review by MADEP. The redevelopment of the golf course as a residential development would most likely be viewed favorably by MADEP due to elimination of the golf course as a potential contamination source.

12.0 Conclusions

Based on the information presented herein, NGI derives the following conclusions regarding potential impacts of the Evergreen Commons OSRD on the yield and water quality of Newburyport Well No. 2:

1. The Evergreen Commons OSRD is a proposed 38 lot residential subdivision on a 36.4 acre parcel of land in Newburyport, MA
2. Currently the site is a golf course with approximately 23.8 acres of maintained turf
3. The site is located in the Zone II Recharge Area of Newburyport Wells No. 1 and No. 2 as delineated by TEEM (1999)
4. Unconsolidated deposits beneath the site and Well No. 2 consist of deposits of sand and gravel of glacial outwash origin and Pleistocene Age
5. Groundwater flow on site is to the northeast at a hydraulic gradient of 0.002 (0.2% slope) and a bedrock high has been identified in the northeastern portion of the site that bisects the flow system
6. TEEM (1999) estimated the transmissivity of the aquifer in the vicinity of Well No. 2 to be approximately 59,700 gpd/ft
7. Well No. 2 is approved to withdrawal water at a rate of 408 gpm. Typically this well operates at a rate of approximately 225 gpm continuously during the summer months
8. The water quality derived from Well No. 2 is excellent and requires treatment for pH and alkalinity adjustment only. There is no history of detection of VOCs, SOCs or IOCs above MCLs from this well.
9. The average nitrate concentration in Well No. 2 (1993-2016) is 1.6 mg/L and the average sodium concentration for the same period is 26.6 mg/L. These data do not indicate existing adverse impacts from fertilization or road salt applications

10. Current land use in Zone II includes 47% forest, 18% residential, 13% golf course, 10% transportation, 10% agricultural and 1% water supply land.
11. Listed contamination sources in Zone II include I-95, the Evergreen Valley Golf Course, St. Mary's Cemetery and gravel pits off Ferry Road.
12. Under current conditions the site includes approximately 23.8 acres of maintained turf, two irrigation withdrawals (approximately 60,000 gpd but seasonal) and an identified potential source of contamination (golf course).
13. Under post development conditions the site will include 38 residential lots with an average lot size of 0.31 acres. The amount of maintained turf under post development conditions will be approximately 9.1 acres or 62% less maintained turf than existing conditions. This will presumably result in a corresponding reduction in the application of turf management products such as herbicides, pesticides and fungicides in the recharge area to Well No. 2.
14. The proposed land use is consistent with existing land use in the area (single family residential). Concerns raised regarding over application of lawn care products, accidental releases of petroleum products or intentional dumping of waste products have not historically resulted in groundwater contamination and are not listed by USEPA or MADEP as potential sources of contamination to be inventoried in Wellhead Protection Areas.
15. Road salt applied to proposed roadways in the Evergreen Commons OSRD are projected to result in an 8% increase in sodium concentrations in Well No. 2 to 29 mg/L and is not anticipated to result in exceedances of the secondary standard of 250 mg/L for sodium.
16. The development of the Evergreen Commons OSRD should not limit the ability of Newburyport to replace or expand Well No. 2.

NGI concludes that the proposed Evergreen Commons, LLC is not a significant or obvious water quality threat to Newburyport Well No. 2. Secondly, replacing the existing golf course with the proposed residential development will eliminate an existing identified potential source of contamination in Zone II and eliminate an existing irrigation withdrawal in Zone II.

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TABLES

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Water Supply & Environmental Consulting

Table 1
Water Level Elevation Data

		9/16/2016	
Well ID	**Elevation**	**DTW**	**Elev**
MW-1	63.4	15.5	47.9
MW-2	65.3	17.1	48.2
MW-3	58.2	11.68	46.52
SB-4	68.4	NA	NA
MW-5	60.2	14.69	45.51
MW-6	59.9	13.24	46.66
MW-7	64.0	17.63	46.37
MW-8	63.2	15.72	47.48
B-4	74.5	31.14	43.36
B-6	65.4	19.65	45.75
B-1	70.5	36.12	34.38
B-2	71.3	28.26	43.04
B-3	74.9	31.25	43.65
B-5	76.1	35.35	40.75
Old Well	60.5	15.08	45.42
IW-2	58.7	11.07	47.63

Notes: DTW - Depth to Water
Elevations in Feet above MSL

Table 2
Water Quality Data for Well No. 2
MADEP Water Quality Data Base

Date	Nitrate (mg/L)
2/26/1993	1.3
5/16/1994	1.6
8/16/1994	1.6
1/9/1995	1.6
6/19/1995	1.5
3/6/1996	0.8
11/13/1996	0.3
3/11/1997	2.0
3/20/1998	1.3
6/16/1999	1.5
3/15/2000	1.6
1/30/2001	1.3
2/7/2002	2.1
3/13/2003	1.6
2/18/2004	2.1
1/25/2006	2.0
2/21/2007	2.0
2/12/2008	1.9
2/10/2009	1.9
1/25/2010	1.8
2/22/2012	1.9
3/5/2014	1.2
1/14/2016	1.7
Average	1.6

Date	Sodium (mg/L)
9/1/1993	21.3
2/11/1994	10.1
3/9/1994	16.5
5/10/1994	17.6
5/12/1995	21.5
3/20/1998	24.0
1/30/2001	41.0
3/13/2003	51.0
1/25/2006	28.0
2/10/2009	23.0
2/22/2012	37.4
1/14/2016	27.4
Average	26.6

Table 3
Existing Roads in Zone II I-95 and East

Road Name	Length (ft)	Width (ft)	Acres
I-95 (east side)	50% of Estimate from MassGIS		11.65
Boyd Drive	1800	24	0.99
Ferry Road	2364	32	1.74
Briggs Avenue	900	24	0.50
Brown Avenue	650	24	0.36
Fenders Avenue	650	24	0.36
Azalea Road	350	24	0.19
Laurel Road	1000	24	0.55
Total			16.33

Proposed Roads in Zone II I-95 and East

Road Name	Length (ft)	Width (ft)	Acres
Upper Road	1050	24	0.58
Lower Road	700	24	0.39
Connector Road	500	36	0.41
Total			1.38

FIGURES

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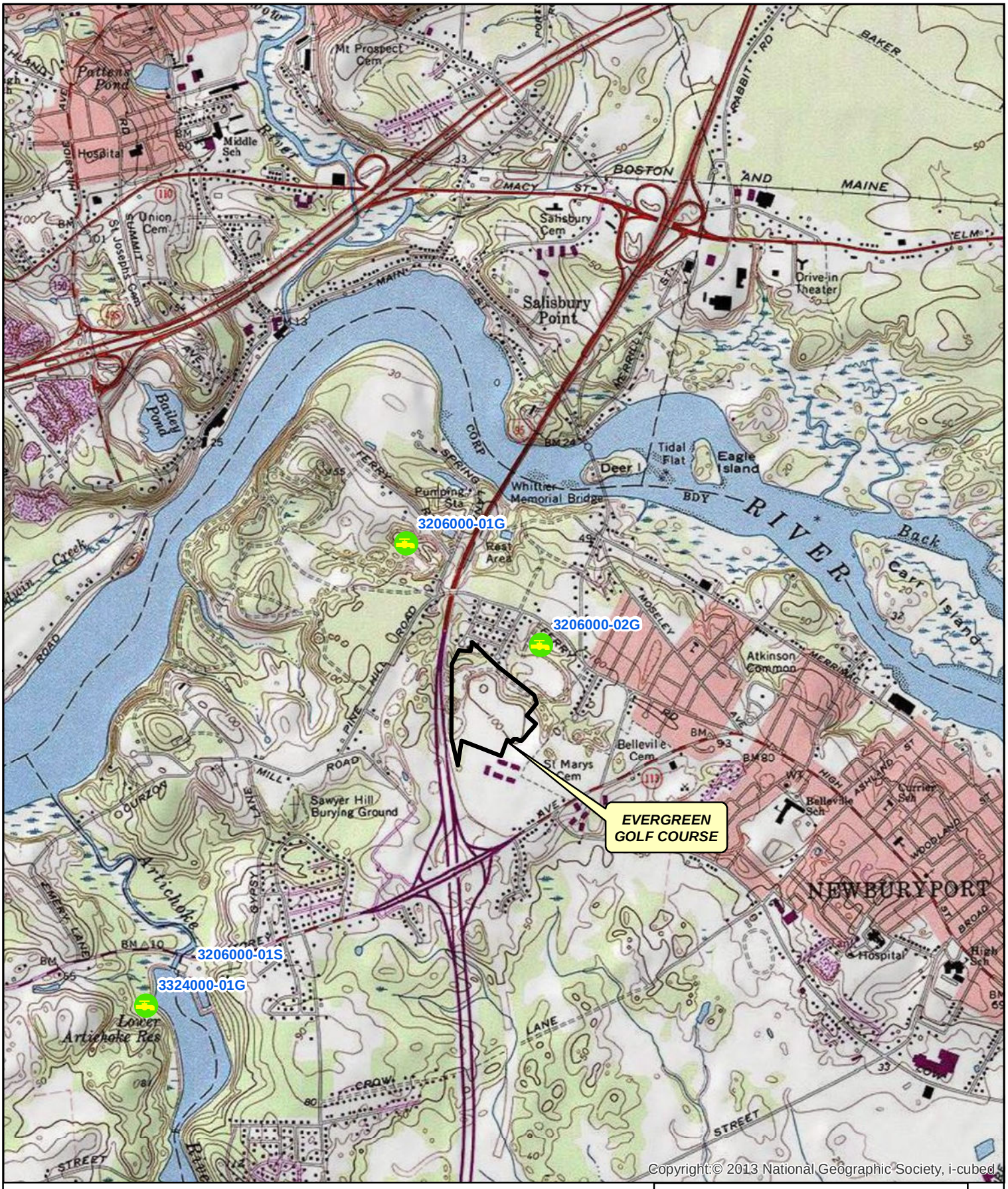

COMMUNITY PUBLIC WATER SUPPLY

ASSESSORS PARCEL

N
W E
S

0 500 1,000 2,000

Feet

NGI
NORTHEAST GEOSCIENCE INC
Water Supply & Environmental Consulting

LOCUS MAP
EVERGREEN COMMONS LLC
18 BOYD DRIVE
NEWBURYPORT, MASSACHUSETTS

NGI REF: LocusMap	
Drafted By: JAF	Date: 09/14/16
Source: MassGIS, ArcGIS.com	

FIGURE 1

NGI
NORTHEAST GEOSCIENCE INC
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97 Walnut Street
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EXISTING PUBLIC WATER SUPPLY
EXISTING MONITORING WELL
EXISTING IRRIGATION WELL
SOIL BORING
ASSESSORS PARCELS

N
W E
S
0 50 100 200
Feet

EXISTING CONDITIONS SITE MAP
EVERGREEN COMMONS LLC
18 BOYD DRIVE
NEWBURYPORT, MASSACHUSETTS

NGI REF: PropCondSitePlan11x17
Drafted By: JAF | Date: 09/19/2016
Source: MassGIS, ArcGIS, Design Consult., Inc.

FIGURE 2

NGI
NORTHEAST GEOSCIENCE INC
Water Supply and Environmental Consulting
97 Walnut Street
Clinton, Massachusetts
978.365.9045
www.ngeo.net

EXISTING PUBLIC WATER SUPPLY

ASSESSORS PARCEL

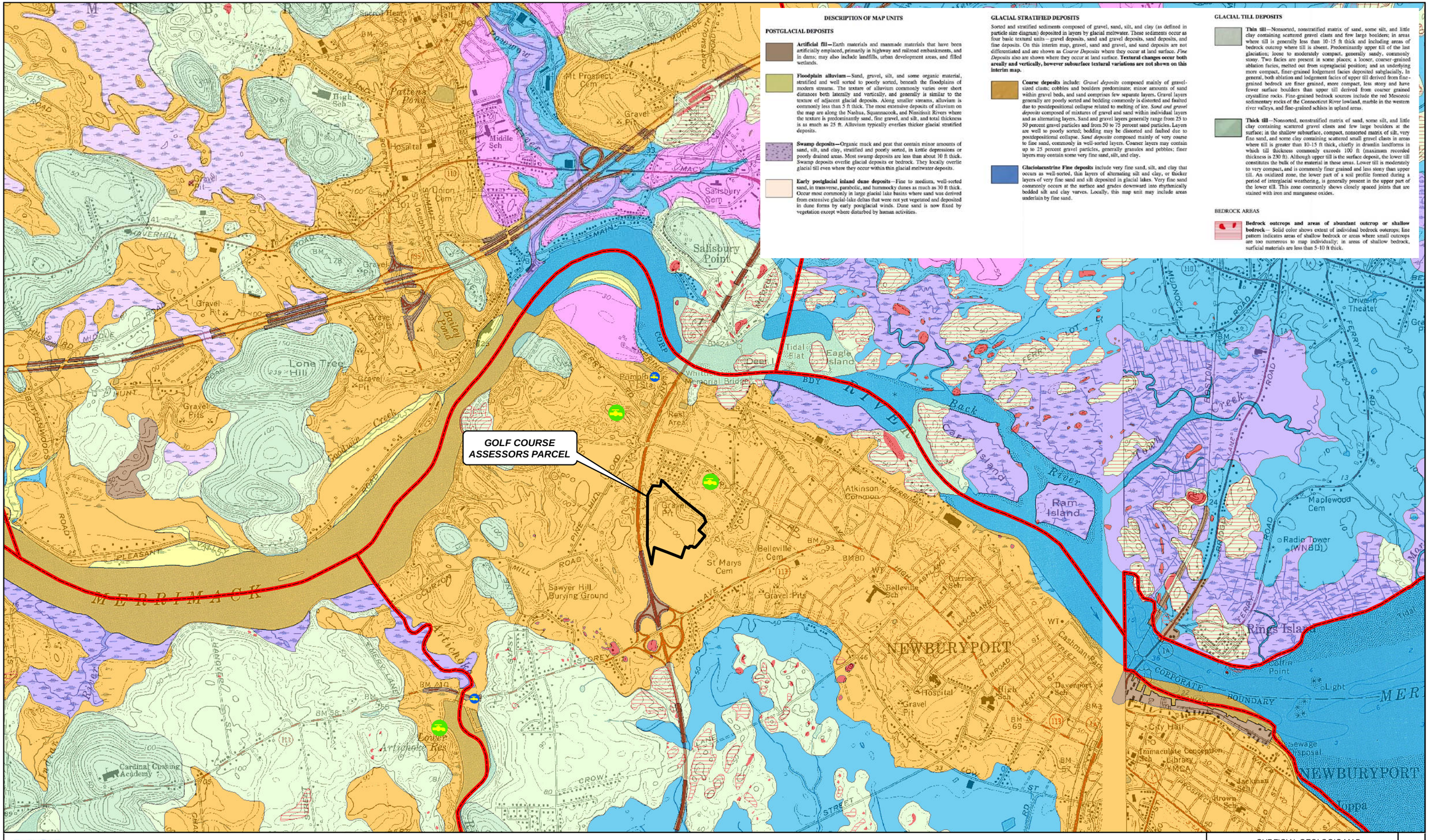
N W E S

0 50 100 200
Feet

PROPOSED CONDITIONS SITE PLAN
EVERGREEN COMMONS LLC
18 BOYD DRIVE
NEWBURYPORT, MASSACHUSETTS

NGI REF: PropCondSitePlan11x17	
Drafted By: JAF	*Date: 09/14/2016*
Source: MassGIS, ArcGIS, Design Consult., Inc.	

FIGURE 3



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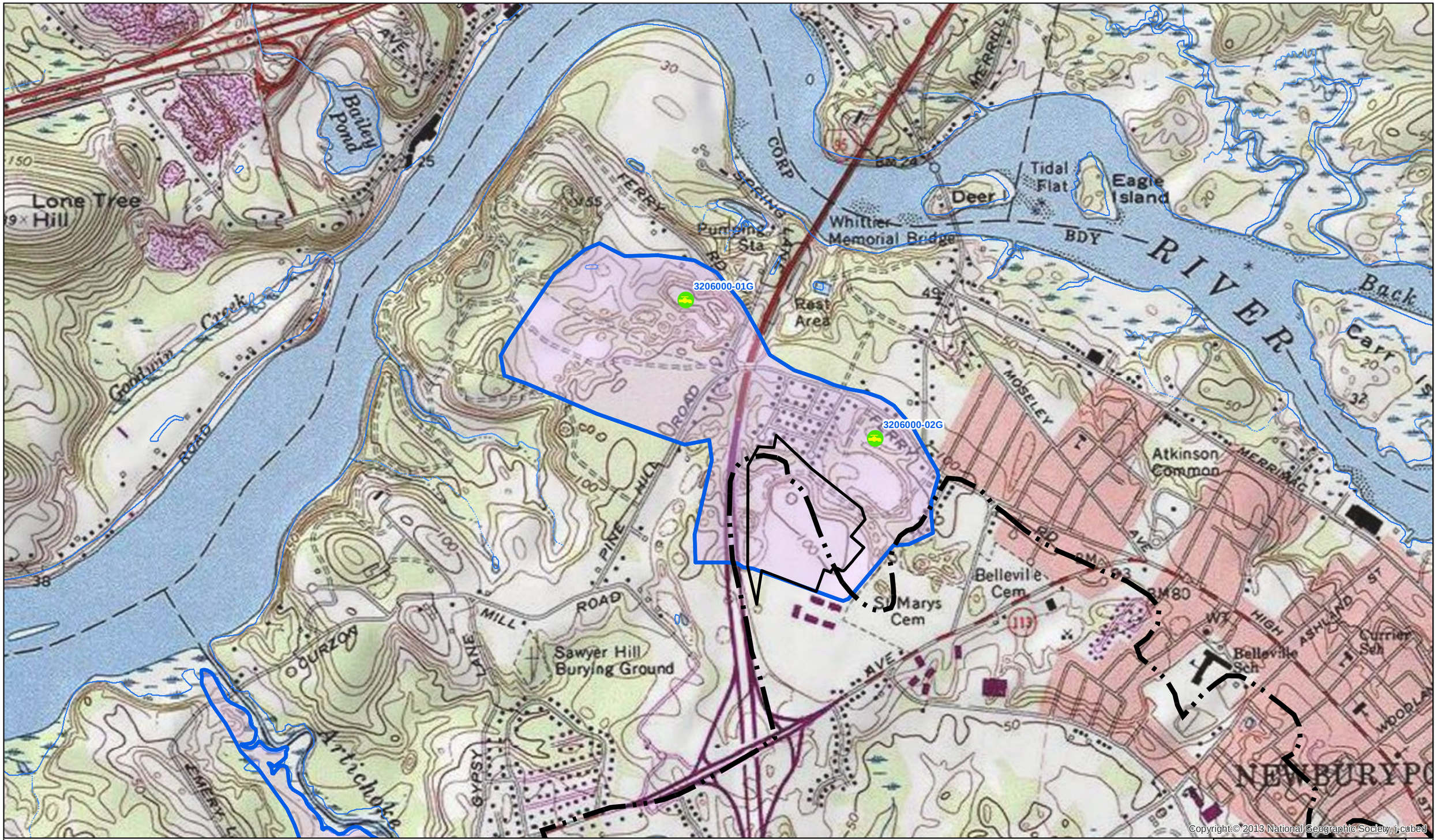
SURFICIAL GEOLOGIC MAP
EVERGREEN COMMONS LLC
18 BOYD DRIVE
NEWBURYPORT, MASSACHUSETTS

NGI REF: SurficialMap11x17
Drafted By: JAF | Date: 08/24/2016
Source: MassGIS, USGS

FIGURE 4



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DRAFT

- *EXISTING PUBLIC WATER SUPPLY*
- *ZONE II RECHARGE AREA*
- *ASSESSORS PARCEL*
- *MERRIMACK RIVER - PARKER RIVER WATERSHED DIVIDE*

N
W E
S

0 250 500 1,000
Feet

ZONE II RECHARGE AREA MAP
EVERGREEN COMMONS LLC
18 BOYD DRIVE
NEWBURYPORT, MASSACHUSETTS

NGI REF: SurficialMap11x17	
Drafted By: JAF	*Date: 09/14/2016*
Source: MassGIS, USGS	

FIGURE 5

- Cropland
- Forest
- Golf Course
- High Density Residential
- Low Density Residential
- Medium Density Residential
- Multi-Family Residential
- Non-Forested Wetland
- Nursery
- Open Land
- Pasture
- Transportation
- Very Low Density Residential
- Waste Disposal
- Water

3206000-01G

3206000-02G

Whittier Memorial Bridge

Rest Area

Pumping Sta

Gravel Pit

ROAD

PINE HILL

MOSELEY

Belleville Cem

St Marys Cem

Zone II Land Use Table

Land Use Description	Acres	Percent
Forest	112.94	47.3
Golf Course	32.02	13.4
Transportation	23.3	9.8
High Density Residential	18.2	7.6
Medium Density Residential	17.56	7.4
Cropland	9.13	3.8
Pasture	8.26	3.5
Open Land	6.48	2.7
Low Density Residential	4.64	1.9
Very Low Density Residential	2.63	1.1
Water	1.79	0.8
Multi-Family Residential	0.63	0.3
Non-Forested Wetland	0.59	0.2
Nursery	0.28	0.1
Waste Disposal	0.09	0.0
Total	238.54	100.0

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EXISTING PUBLIC WATER SUPPLY

ASSESSORS PARCEL

ZONE II RECHARGE AREA

N W E S

0 125 250 500
Feet

EXISTING LAND USE MAP FOR ZONE II
EVERGREEN COMMONS LLC
18 BOYD DRIVE
NEWBURYPORT, MASSACHUSETTS

NGI REF: LandUseMap11x17
Drafted By: JAF | *Date: 09/14/2016*
Source: MassGIS, USGS

FIGURE 6

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EXISTING PUBLIC WATER SUPPLY
ASSESSORS PARCEL
BEDROCK HIGH
GROUNDWATER FLOW LINE
GROUNDWATER ELEVATION CONTOUR (FT)

NOTE:
GROUNDWATER CONTOURS, BEDROCK HIGH AND GROUNDWATER FLOW LINES FROM BSC GROUP REPORT DATED AUGUST 22, 1985.

N
W E
S
0 50 100 200
Feet

BSC GROUP GROUNDWATER CONTOUR MAP
EVERGREEN COMMONS LLC
18 BOYD DRIVE
NEWBURYPORT, MASSACHUSETTS

NGI REF: BscGwContMap11x17
Drafted By: JAF | Date: 09/14/2016
Source: MassGIS, ArcGIS, Design Consult., Inc.

FIGURE 7

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- EXISTING PUBLIC WATER SUPPLY
- EXISTING MONITORING WELL
- EXISTING IRRIGATION WELL
- SOIL BORING
- ASSESSORS PARCELS
- GROUNDWATER FLOW LINE
- 48 GROUNDWATER ELEVATION CONTOUR (FT)
- BEDROCK HIGH

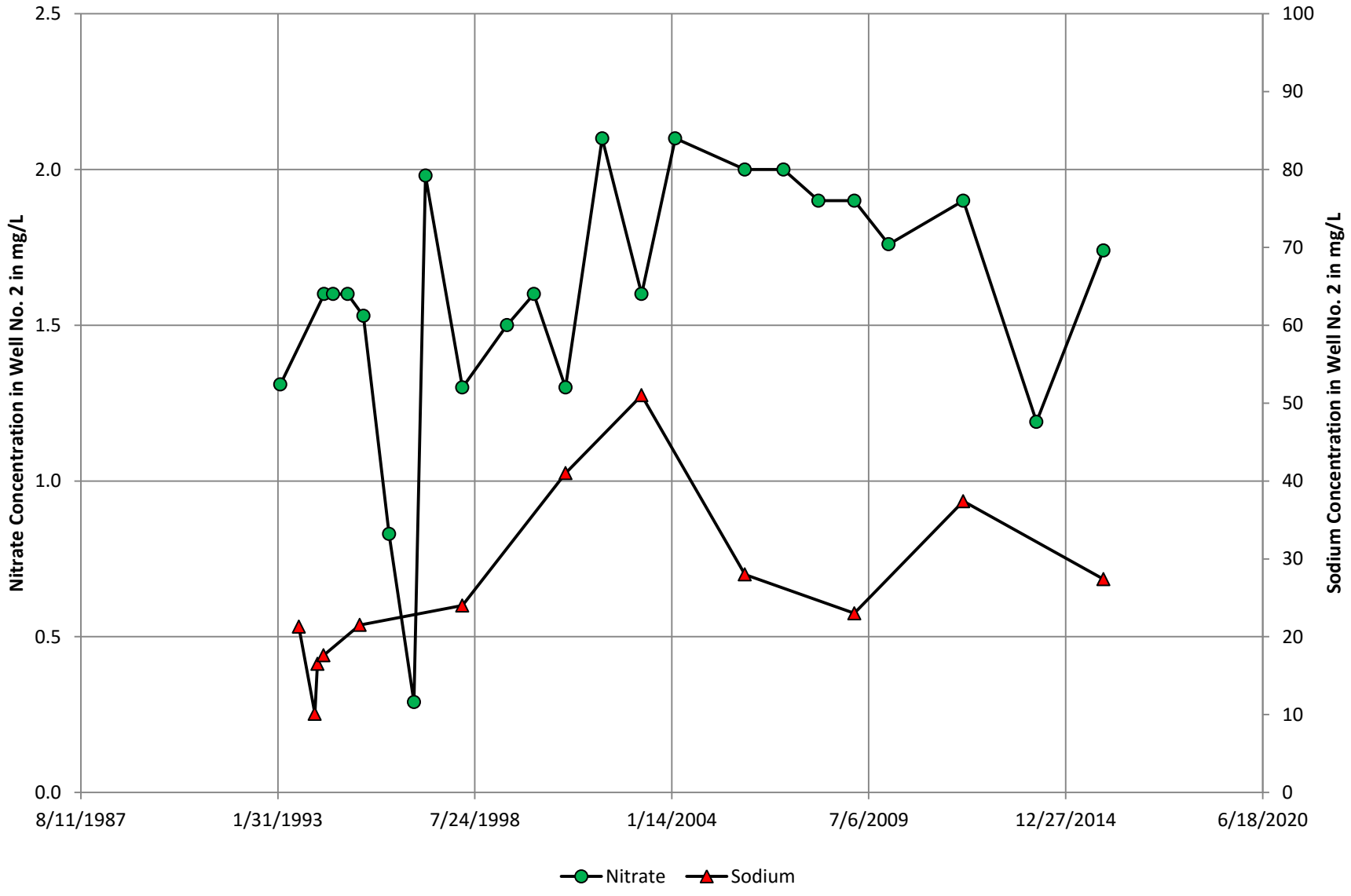
N
W E
S
0 50 100 200
Feet

NGI GROUNDWATER MAP 09/16/16
EVERGREEN COMMONS LLC
18 BOYD DRIVE
NEWBURYPORT, MASSACHUSETTS

NGI REF: NgiGwContMap11x17	
Drafted By: JAF	Date: 09/19/2016
Source: MassGIS, ArcGIS, Design Consult., Inc.	

FIGURE 8

Figure 9 - Nitrate Concentration Trends in Newburyport Well No. 2



APPENDIX A

NGI

NORTHEAST GEOSCIENCE INC

Water Supply & Environmental Consulting

NORTHEAST GEOSCIENCE INC

WATER SUPPLY AND ENVIRONMENTAL CONSULTING

97 WALNUT STREET, CLINTON, MA 01510, 978-365-9045

WELL LOG

MW-1

Project:	Evergreen Commons	Client:	Cottage Advisors, LLC
Project #:	160801	Casing Elevation:	63.4
Location:	Newburyport, MA	Total Depth:	25 ft BGS
ID:	MW-1	Screen Diameter:	2-inch
Water Level:	15.44 feet from TOC	Slot Size:	0.010
Screen Length:	10 feet	Casing Diameter:	2-inch
Screen Type:	PVC	Type:	PVC
Casing Length:	15 feet	Operator:	Don Watson
Depth:	25 feet	Company:	Technical Drilling Services
Method:	Hollow Stem Auger	NGI Inspector:	JGB
Date Start:	9/9/2016	Date End:	9/9/2016

Sketch Map (not to scale)

SEE SITE PLAN

Depth (ft BGS)	Well Construction	Sample ID	Sample Depth (feet)	Blows/6"	Pen/Rec ("/24")	Sample Description
0	2" PVC Casing					
		S-1	0-2	5-10-25-28	16/24	Dry loose light brown fine to medium sand, tr. Organics
5		S-2	5-7	7-7-7-9	14/24	Dry loose light brown medium sand, some coarse sand and gravel
10	Bentonite Seal	S-3	10-12	7-12-10-8	13/24	Dry loose light brown medium to coarse sand
15	Water at 15.44	S-4	15-17	8-6-10-15	14/24	Wet loose light brown medium sand, tr. coarse sand
20	Sand Pack	S-5	20-22	1-2-1-2	14/24	Wet brown loose medium to coarse sand
	2" PVC Screen					
25		S-6	25-27	2-5-6-9	20/24	Wet loose light brown medium to coarse sand
	Bottom of Boring at 25 feet					

NORTHEAST GEOSCIENCE INC

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WELL LOG

MW-2

Project:	Evergreen Commons	Client:	Cottage Advisors, LLC
Project #:	160801	Casing Elevation:	65.3
Location:	Newburyport, MA	Total Depth:	25 ft BGS
ID:	MW-2	Screen Diameter:	2-inch
Water Level:	17.07 feet from TOC	Slot Size:	0.010
Screen Length:	10 feet	Casing Diameter:	2-inch
Screen Type:	PVC	Type:	PVC
Casing Length:	15 feet	Operator:	Don Watson
Depth:	25 feet	Company:	Technical Drilling Services
Method:	Hollow Stem Auger	NGI Inspector:	JGB
Date Start:	9/9/2016	Date End:	9/9/2016

Sketch Map (not to scale)

SEE SITE PLAN

Depth (ft BGS)	Well Construction	Sample ID	Sample Depth (feet)	Blows/6"	Pen/Rec ("/24")	Sample Description
0	2" PVC Casing					
		S-1	0-2	6-7-15-11	18/24	Dry loose light brown fine sand and silt
5		S-2	5-7	6-6-7-7	18/24	Dry loose light brown fine sand and silt
10	Bentonite Seal	S-3	10-12	6-6-8-9	22/24	Damp, medium dense brown silty fine sand
15	Water at 17.07	S-4	15-17	6-6-8-9	22/24	Wet medium dense brown silty fine sand
20	Sand Pack	S-5	20-22	3-3-6-6	24/24	Wet medium dense brown silty fine sand
	2" PVC Screen					
25		S-6	25-27	5-6-10-14	20/24	Wet medium dense brown silty fine sand
	Bottom of Boring at 25 feet					

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WATER SUPPLY AND ENVIRONMENTAL CONSULTING

97 WALNUT STREET, CLINTON, MA 01510, 978-365-9045

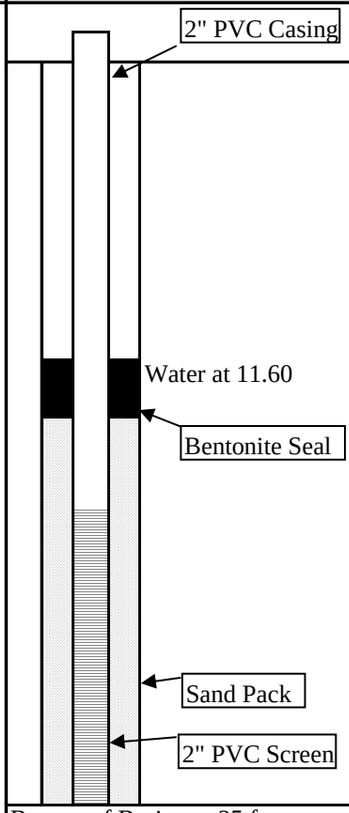
WELL LOG

MW-3

Project:	Evergreen Commons	Client:	Cottage Advisors, LLC
Project #:	160801	Casing Elevation:	58.2
Location:	Newburyport, MA	Total Depth:	25 ft BGS
ID:	MW-3	Screen Diameter:	2-inch
Water Level:	11.60 feet from TOC	Slot Size:	0.010
Screen Length:	10 feet	Casing Diameter:	2-inch
Screen Type:	PVC	Type:	PVC
Casing Length:	15 feet	Operator:	Don Watson
Depth:	25 feet	Company:	Technical Drilling Services
Method:	Hollow Stem Auger	NGI Inspector:	JGB
Date Start:	9/9/2016	Date End:	9/9/2016

Sketch Map (not to scale)

SEE SITE PLAN

Depth (ft BGS)	Well Construction	Sample ID	Sample Depth (feet)	Blows/6"	Pen/Rec ("/24")	Sample Description
0						
		S-1	0-2	6-9-16-17	24/24	Dry dark brown loose sandy loam
5		S-2	5-7	10-11-8-8	20/24	Dry loose light brown medium sand
10		S-3	10-12	6-8-8-9	18/24	Wet loose reddish brown medium to coarse sand, some gravel
15		S-4	15-17	3-4-6-6	24/24	Wet medium dense reddish brown fine sand, some silt
20		S-5	20-22	4-4-5-9	22/24	Wet medium dense light brown to grey fine sand
25		S-6	25-27	6-5-4-4	18/24	Wet medium dense reddish brown medium sand
	Bottom of Boring at 25 feet					

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WELL LOG

SB-4

Project:	Evergreen Commons	Client:	Cottage Advisors, LLC
Project #:	160801	Casing Elevation:	68.4 gr.
Location:	Newburyport, MA	Total Depth:	12 ft BGS
ID:	SB-4	Screen Diameter:	NA
Water Level:	No water encountered	Slot Size:	NA
Screen Length:	No screen	Casing Diameter:	NA
Screen Type:	NA	Type:	NA
Casing Length:	No casing	Operator:	Don Watson
Depth:	12 feet	Company:	Technical Drilling Services
Method:	Hollow Stem Auger	NGI Inspector:	JGB
Date Start:	9/9/2016	Date End:	9/9/2016

Sketch Map (not to scale)

SEE SITE PLAN

Depth (ft BGS)	Well Construction	Sample ID	Sample Depth (feet)	Sample Blows/6"	Sample Pen/Rec ("/24")	Sample Description
0						
		S-1	0-2	6-9-5-11	16/24	Dry dark brown loose sandy loam
5		S-2	5-7	5-6-7-9	14/24	Dry loose light brown fine silty sand
10		S-3	10-12	22-23-12-12	18/24	Dry dense light brown fine sand, some silt
	Bottom of Boring at 12 feet - Refusal on Bedrock					

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WELL LOG

MW-5

Project:	Evergreen Commons	Client:	Cottage Advisors, LLC
Project #:	160801	Casing Elevation:	60.2
Location:	Newburyport, MA	Total Depth:	25 ft BGS
ID:	MW-5	Screen Diameter:	2-inch
Water Level:	14.62 feet from TOC	Slot Size:	0.010
Screen Length:	10 feet	Casing Diameter:	2-inch
Screen Type:	PVC	Type:	PVC
Casing Length:	15 feet	Operator:	Don Watson
Depth:	25 feet	Company:	Technical Drilling Services
Method:	Hollow Stem Auger	NGI Inspector:	JGB
Date Start:	9/12/2016	Date End:	9/12/2016

Sketch Map (not to scale)

SEE SITE PLAN

Depth (ft BGS)	Well Construction	Sample ID	Sample Depth (feet)	Blows/6"	Pen/Rec ("/24")	Sample Description
0	2" PVC Casing					
5		S-1	5-7	12-11-14-20	16/24	Dry, loose dark brown fine sand and silt, tr. Gravel
10	Bentonite Seal	S-2	10-12	9-14-13-11	15/24	Dry loose brown fine sand and silt, some gravel
15	Water at 14.62	S-3	15-17	12-7-6-8	15/24	Wet loose brown medium to coarse sand, some fine sand
20	Sand Pack	S-4	20-22	8-7-7-8	10/24	Wet loose brown medium to coarse sand and gravel
25	2" PVC Screen					
	Bottom of Boring at 25 feet					

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WATER SUPPLY AND ENVIRONMENTAL CONSULTING

97 WALNUT STREET, CLINTON, MA 01510, 978-365-9045

WELL LOG

MW-6

Project:	Evergreen Commons	Client:	Cottage Advisors, LLC
Project #:	160801	Casing Elevation:	59.9
Location:	Newburyport, MA	Total Depth:	25 ft BGS
ID:	MW-6	Screen Diameter:	2-inch
Water Level:	13.18 feet from TOC	Slot Size:	0.010
Screen Length:	10 feet	Casing Diameter:	2-inch
Screen Type:	PVC	Type:	PVC
Casing Length:	15 feet	Operator:	Don Watson
Depth:	25 feet	Company:	Technical Drilling Services
Method:	Hollow Stem Auger	NGI Inspector:	JGB
Date Start:	9/12/2016	Date End:	9/12/2016

Sketch Map (not to scale)

SEE SITE PLAN

Depth (ft BGS)	Well Construction	Sample ID	Sample Depth (feet)	Sample Blows/6"	Sample Pen/Rec ("/24")	Sample Description
0	2" PVC Casing					
5		S-1	5-7	8-10-7-12	17/24	Dry loose light brown medium to coarse sand, some gravel
10	Bentonite Seal	S-2	10-12	4-4-5-4	16/24	Damp, loose brown medium sand, some coarse sand
	Water at 13.18					
15		S-3	15-17	3-8-13-18	14/24	Wet loose reddish brown coarse sand and gravel
20	Sand Pack	S-4	20-22	3-5-4-7	17/24	Wet loose brown medium to coarse sand, some gravel
	2" PVC Screen					
25		S-5	25-27	3-4-4-8	9/24	Wet loose brown medium sand, some coarse sand
	Bottom of Boring at 25 feet					

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WATER SUPPLY AND ENVIRONMENTAL CONSULTING

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WELL LOG

MW-7

Project:	Evergreen Commons	Client:	Cottage Advisors, LLC
Project #:	160801	Casing Elevation:	64.0
Location:	Newburyport, MA	Total Depth:	20 ft BGS
ID:	MW-7	Screen Diameter:	2-inch
Water Level:	17.57 feet from TOC	Slot Size:	0.010
Screen Length:	10 feet	Casing Diameter:	2-inch
Screen Type:	PVC	Type:	PVC
Casing Length:	10 feet	Operator:	Don Watson
Depth:	20 feet	Company:	Technical Drilling Services
Method:	Hollow Stem Auger	NGI Inspector:	JGB
Date Start:	9/12/2016	Date End:	9/12/2016

Sketch Map (not to scale)

SEE SITE PLAN

Depth (ft BGS)	Well Construction	Sample ID	Sample Depth (feet)	Sample Blows/6"	Sample Pen/Rec ("/24")	Sample Description
0	2" PVC Casing					
5	Bentonite Seal	S-1	5-7	4-4-3-5	14/24	Dry, dark brown loose fine sand and silt, trace organics
10	2" PVC Screen	S-2	10-12	12-11-8-6	1/24	No recovery
15	Sand Pack; Water at 17.57	S-3	15-17	5-7-11-8	6/24	Wet dense dark brown silty sand, trace grave
20		S-4	20-22	8-10-12-16	22/24	Wet dense dark brown silt and fine sand
	Bottom of Boring at 20 feet					

NORTHEAST GEOSCIENCE INC

WATER SUPPLY AND ENVIRONMENTAL CONSULTING

97 WALNUT STREET, CLINTON, MA 01510, 978-365-9045

WELL LOG

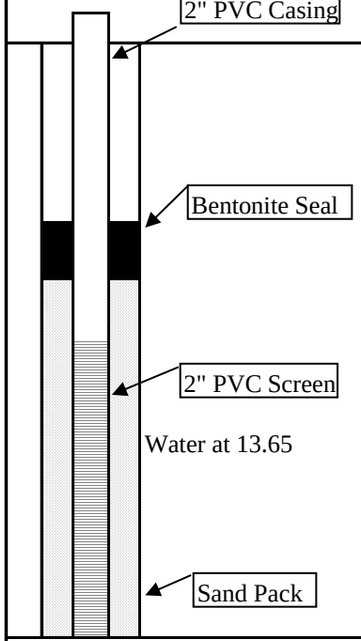
MW-8

Project:	Evergreen Commons	Client:	Cottage Advisors, LLC
Project #:	160801	Casing Elevation:	63.2
Location:	Newburyport, MA	Total Depth:	20 ft BGS
ID:	MW-8	Screen Diameter:	2-inch
Water Level:	13.65 feet from TOC	Slot Size:	0.010
Screen Length:	10 feet	Casing Diameter:	2-inch
Screen Type:	PVC	Type:	PVC
Casing Length:	10 feet	Operator:	Don Watson
Depth:	20 feet	Company:	Technical Drilling Services
Method:	Hollow Stem Auger	NGI Inspector:	JGB
Date Start:	9/12/2016	Date End:	9/12/2016

Sketch Map (not to scale)

SEE SITE PLAN

Depth (ft BGS)	Well Construction	Sample ID	Sample Depth (feet)	Blows/6"	Pen/Rec ("/24")	Sample Description
0	2" PVC Casing					
5	Bentonite Seal	S-1	5-7	4-3-3-7	24-Dec	Dry loose reddish brown medium sand
10	2" PVC Screen	S-2	10-12	8-6-6-8	14/24	Same as above
	Water at 13.65					
15		S-3	15-17	5-5-9-9	13/24	Wet, loose reddish brown medium to coarse sand
	Sand Pack					
20		S-4	20-22	8-7-8-12	20/24	Wet loose reddish brown fine to coarse sand
	Bottom of Boring at 20 feet					



APPENDIX B

NGI

NORTHEAST GEOSCIENCE INC

Water Supply & Environmental Consulting

NEWBURYPORT - NITRATE

ARTICHOKE/INDIAN HILLS (01S,02S)

COLLECTION DATE	RAW/FIN	CHEMICAL NAME	RESULT	UNITS	DETECTION LIMIT
9/9/1993	F	NITRATE	0.08	mg/L	0.05

OLD LOC. NO.-- (01S,02S,01G)

COLLECTION DATE	RAW/FIN	CHEMICAL NAME	RESULT	UNITS	DETECTION LIMIT
2/11/1994	F	NITRATE	0.9	mg/L	0
11/13/1996	F	NITRATE	0.07	mg/L	0.01
1/25/2006	F	NITRATE	0.49	mg/L	0.02

OLD LOCATION NO. - WTP - FINISHED (01S,02S,01G)

COLLECTION DATE	RAW/FIN	CHEMICAL NAME	RESULT	UNITS	DETECTION LIMIT
2/26/1993	F	NITRATE	1.01	mg/L	0.01
11/22/1993	F	NITRATE	0.11	mg/L	0
6/19/1995	F	NITRATE	0.61	mg/L	0
3/6/1996	F	NITRATE	0.91	mg/L	0.02
3/11/1997	F	NITRATE	0.08	mg/L	0.01
6/16/1999	F	NITRATE	0.38	mg/L	0.02
1/30/2001	F	NITRATE	0.23	mg/L	0.02

2/7/2002	F	NITRATE	0.39	mg/L	0.02
3/13/2003	F	NITRATE	1.1	mg/L	0.02
2/18/2004	F	NITRATE	0.18	mg/L	0.02
3/2/2005	F	NITRATE	0.29	mg/L	0.02

WELL # 1

COLLECTION DATE	RAW/FIN	CHEMICAL NAME	RESULT	UNITS	DETECTION LIMIT
1/9/1995	F	NITRATE	1.4	mg/L	0
3/15/2000	F	NITRATE	0.1	mg/L	0.02

WELL # 2 - ENTRY POINT TO DISTRIBUTION SYSTEM

COLLECTION DATE	RAW/FIN	CHEMICAL NAME	RESULT	UNITS	DETECTION LIMIT
2/26/1993	F	NITRATE	1.31	mg/L	0.01
5/16/1994	F	NITRATE	1.6	mg/L	0
8/16/1994	F	NITRATE	1.6	mg/L	0.012
1/9/1995	F	NITRATE	1.6	mg/L	0
6/19/1995	F	NITRATE	1.53	mg/L	0
3/6/1996	F	NITRATE	0.83	mg/L	0.02
11/13/1996	F	NITRATE	0.29	mg/L	0.01
3/11/1997	F	NITRATE	1.98	mg/L	0.01
3/20/1998	F	NITRATE	1.3	mg/L	0.02

6/16/1999	F	NITRATE	1.5	mg/L	0.02
3/15/2000	F	NITRATE	1.6	mg/L	0.02
1/30/2001	F	NITRATE	1.3	mg/L	0.02
2/7/2002	F	NITRATE	2.1	mg/L	0.02
3/13/2003	F	NITRATE	1.6	mg/L	0.02
2/18/2004	F	NITRATE	2.1	mg/L	0.02
1/25/2006	F	NITRATE	2	mg/L	0.02
2/21/2007	F	NITRATE	2	mg/L	0.02
2/12/2008	F	NITRATE	1.9	mg/L	0.05
2/10/2009	F	NITRATE	1.9	mg/L	0.02
1/25/2010	F	NITRATE	1.76	mg/L	0.03
2/22/2012	F	NITRATE	1.9	mg/L	0.15
1/30/2013	F	NITRATE	1.84	mg/L	0.03
3/5/2014	F	NITRATE	1.19	mg/L	0.03
1/14/2016	F	NITRATE	1.74	mg/L	0.03

WTP - FINISHED (01S,02S,03S,01G)

COLLECTION DATE	RAW/FIN	CHEMICAL NAME	RESULT	UNITS	DETECTION LIMIT
2/21/2007	F	NITRATE	0.16	mg/L	0.02
2/12/2008	F	NITRATE	0.7	mg/L	0.05

2/10/2009	F	NITRATE	0.38	mg/L	0.02
1/25/2010	F	NITRATE	0.44	mg/L	0.03
2/22/2012	F	NITRATE	0	mg/L	0.03
1/30/2013	F	NITRATE	0.43	mg/L	0.03
3/5/2014	F	NITRATE	0.93	mg/L	0.03
1/14/2016	F	NITRATE	0.27	mg/L	0.03

NEWBURYPORT - SODIUM

ARTICHOKE RES. (01S)

COLLECTION DATE	RAW/FIN	CHEMICAL NAME	RESULT	UNITS	DETECTION LIMIT
9/1/1993	F	SODIUM	40.7	mg/L	1
3/9/1994	F	SODIUM	35.8	mg/L	0.001

OLD LOC. NO.-- (01S,02S,01G)

COLLECTION DATE	RAW/FIN	CHEMICAL NAME	RESULT	UNITS	DETECTION LIMIT
2/11/1994	F	SODIUM	36.2	mg/L	0.001
5/10/1994	F	SODIUM	28.5	mg/L	0.001
3/2/2004	F	SODIUM	55	mg/L	1

OLD LOCATION NO. - WTP - FINISHED (01S,02S,01G)

COLLECTION DATE	RAW/FIN	CHEMICAL NAME	RESULT	UNITS	DETECTION LIMIT
5/12/1995	F	SODIUM	22.2	mg/L	0.001
3/6/1996	F	SODIUM	29.1	mg/L	0.05
3/11/1997	F	SODIUM	32	mg/L	5
3/20/1998	F	SODIUM	21	mg/L	5
6/16/1999	F	SODIUM	36	mg/L	1
7/8/1999	F	SODIUM	36	mg/L	1

3/15/2000	F	SODIUM	36	mg/L	1
1/30/2001	F	SODIUM	38	mg/L	1
1/30/2001	F	SODIUM	38	mg/L	1
2/7/2002	F	SODIUM	20	mg/L	1
3/13/2003	F	SODIUM	49	mg/L	1
3/2/2005	F	SODIUM	52	mg/L	1
2/7/2006	F	SODIUM	42	mg/L	1
2/21/2007	F	SODIUM	38	mg/L	1

WELL # 1

COLLECTION DATE	RAW/FIN	CHEMICAL NAME	RESULT	UNITS	DETECTION LIMIT
3/9/1994	F	SODIUM	8.8	mg/L	0.001
5/10/1994	F	SODIUM	28.5	mg/L	0.001
5/12/1995	F	SODIUM	4.8	mg/L	0.001

WELL # 2 - ENTRY POINT TO DISTRIBUTION SYSTEM

COLLECTION DATE	RAW/FIN	CHEMICAL NAME	RESULT	UNITS	DETECTION LIMIT
9/1/1993	F	SODIUM	21.3	mg/L	1
2/11/1994	F	SODIUM	19.1	mg/L	0.001
3/9/1994	F	SODIUM	16.5	mg/L	0.001
5/10/1994	F	SODIUM	17.6	mg/L	0.001

5/12/1995	F	SODIUM	21.5	mg/L	0.001
3/20/1998	F	SODIUM	24	mg/L	5
1/30/2001	F	SODIUM	41	mg/L	1
3/13/2003	F	SODIUM	51	mg/L	1
1/25/2006	F	SODIUM	28	mg/L	1
1/25/2006	F	SODIUM	28	mg/L	1
2/10/2009	F	SODIUM	23	mg/L	1
2/22/2012	F	SODIUM	37.4	mg/L	0.5
1/14/2016	F	SODIUM	27.4	mg/L	0.5

WTP - FINISHED (01S,02S,03S,01G)

COLLECTION DATE	RAW/FIN	CHEMICAL NAME	RESULT	UNITS	DETECTION LIMIT
2/12/2008	F	SODIUM	51	mg/L	1
2/10/2009	F	SODIUM	47	mg/L	1
1/25/2010	F	SODIUM	41.4	mg/L	0.5
1/25/2011	F	SODIUM	48.9	mg/L	0.5
2/22/2012	F	SODIUM	45.9	mg/L	0.5
1/30/2013	F	SODIUM	34.4	mg/L	0.5
3/5/2014	F	SODIUM	61	mg/L	0.5
1/14/2016	F	SODIUM	47.4	mg/L	5

Newburyport Water Works

Annual Water Quality Report to Our Customers

January 1, 2014 - December 31, 2014

Important Information about Your Drinking Water

If you have questions about this report, call the water treatment plant at (978) 465-4466
or send an e-mail to "tsmolski@cityofnewburyport.com".

Quality of Your Drinking Water

Federal regulations require that we report to you each year about the quality of our drinking water. The Newburyport Water Works (Public Water Supply No. 3206000) is committed to providing our customers with high quality drinking water. To ensure delivery of a quality product, we have made significant investments in treatment facilities, water quality monitoring, source protection and the distribution system. We are pleased to report the results of our 2014 water-testing program. In addition to water quality test results, this report provides information about the water system such as where your water comes from and how it is treated.

Water Quality Testing

The Newburyport water treatment plant operates 24 hours per day, 365 days per year. The plant is staffed by trained personnel who have taken required drinking water examinations and have been certified by the State as operators of drinking water facilities. Each year Newburyport Water Works, along with state certified laboratories, conduct thousands of tests to monitor water quality and look for more than 120 potential contaminants.

Where Your Drinking Water Comes From

Our drinking water comes from both surface water and groundwater supplies. The surface supplies, which make up 80% of our water, are the Indian Hill Reservoir in West Newbury, the Artichoke Reservoir in both West Newbury and Newburyport, and the Bartlett Spring Pond in Newburyport. Surface water is treated at the water treatment plant where color, turbidity and bacteria are removed through filtration. The water is then treated for corrosion control, pH adjustment, disinfection and fluoridation before delivery to our customers. Groundwater, which makes up 20% of our drinking water, is supplied by two gravel packed wells (Well #1 and Well #2) located along Ferry Road in Newburyport.

Source Water Assessment Program

The Department of Environmental Protection (DEP) prepared a Source Water Assessment Program (SWAP) Report for the water supply sources serving this water system. This report notes the key land uses within the water supply protection areas for each source and the potential contamination from these land uses. The watersheds for our sources are primarily of a mixture of residential, agricultural, recreational and forestland. The City of Newburyport has enacted a resource protection ordinance to protect our water supplies. Additionally, the City has developed a surface water supply protection plan to help monitor and preserve our surface water sources. Residents can help protect the water sources by being careful in the use and storage of hazardous materials such as paints, solvents, pesticides and fertilizers. The complete SWAP report is available at the Newburyport water treatment plant, Newburyport Board of Health or online at www.state.ma.us/dep/brp/dws/. For more information, contact Tom Smolski at (978) 465-4466.

Water Treatment Processes

In order to meet state and federal requirements for public drinking water, our drinking waters receive the following physical and chemical treatments before being supplied to our customers:

SURFACE WATER

- Pretreatment chemicals are added to coagulate impurities that are then settled out in larger sedimentation tanks.
- Water is then filtered through two 40-inch deep mixed media filters to removed particles.
- Chlorine is added to disinfect water to prevent waterborne diseases.
- The pH of the water is raised to reduce the acidity of the water, helping to prevent internal plumbing corrosion.
- A corrosion inhibitor is used to minimize the pickup of lead and copper from household plumbing into the tap water.
- Sodium fluoride is added to help prevent tooth decay.

WELL WATER

The well water does not require pretreatment chemicals for coagulation or filtration. It is however treated with chlorine, fluoride, corrosion inhibitor and pH adjustment.

Vulnerability

Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. EPA/CDC guidelines on appropriate means to lessen the risk of infection by *Cryptosporidium* and other microbial contaminants are available from the Safe Drinking Water Hotline (800-426-4791).

Water Conservation

By far the most common cause of unexpected high water bills are leaks in home toilets or from excessive outdoor water use. Most toilet leaks aren't easily seen and can't be heard. A leaky toilet may cost you as much as $200 extra on your water bill (not to mention your sewer bill). The quickest way to detect a leaking toilet is to place drops of food coloring into the toilet tank and see if the color comes into the bowl. If color comes into the bowl, this is an indication that your toilet is leaking water.

Things You Can Do To Conserve Water Inside

- Turn off the faucet while you brush your teeth, shave, or clean fruits or vegetables.
- Take shorter showers.
- Don't use your toilet as a waste basket.
- Run the dishwasher and washing machine only when you have a full load.
- Fix leaking faucets and toilets.

Things You Can Do To Conserve Water Outside

- Outfit garden hoses with shut-off nozzles.
- Water your lawn and garden only when needed.
- Water when evaporation rates are at the lowest, during the cool period of the day, first thing in the morning.
- Check for and fix any leaks in outdoor hoses, pipes, faucets and connections.
- Plant drought-tolerant trees and shrubs.
- Do not use automatic timed lawn sprinklers, turn them on and off by hand.

Substances Found in Your Tap Water

Drinking water, including bottled water, may be reasonably expected to contain at least some small amounts of certain substances which EPA calls "contaminants". The presence of these substances does not necessarily indicate that the water poses a health risk. For example, as water travels over the surface of the land or through the ground, it can dissolve naturally occurring minerals. More information about the substances found in your water and their potential health effects can be obtained by calling the Environmental Protection Agency's Safe Drinking Water Hotline (800-426-4791).

Contaminants that May Be Present in Source Waters

Microbial contaminants, such as viruses and bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations and wildlife.

Inorganic contaminants, such as salts and metals, which can be naturally-occurring or result from urban storm water runoff, industrial or domestic wastewater discharge, oil and gas production, mining and farming.

Pesticides and herbicides, which may come from a variety of sources such as agricultural, urban storm water runoff, and residential use.

Organic chemical contaminants, including synthetic and volatile organic chemicals, which are by-products of industrial processes and petroleum production, and can also come from gas stations, urban storm water runoff, and septic systems.

Radioactive contaminants, which can be naturally occurring or be the result of oil and gas production and mining activities.

In order to ensure that tap water is safe to drink, the DEP and EPA prescribe regulations that limit the amount of certain contaminants in water provided by public water systems. The Food and Drug Administration (FDA) and Massachusetts department of Public Health (DPH) regulations establishing limits for contaminants in bottled water that must provide the same protection for public health.

Lead in Drinking Water

If present, elevated levels of lead can cause serious health problems, especially for pregnant woman and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. The Newburyport Water Works is responsible for providing high quality drinking water, but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking. If you are concerned about lead in your drinking water, you may wish to have your water tested. Information on lead in drinking water , testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline or at: http://www.epa.gov/safewater/lead.

Cryptosporidium

Cryptosporidium is a microbial parasite found in surface water throughout the U.S. Although filtration removes Cryptosporidium, the most commonly used filtration methods cannot guarantee 100% removal. Our monitoring indicates the presence of these organisms in our source water. Current test methods do not allow us to determine if the organisms are dead or if they are capable of causing disease. Symptoms of infection include nausea, diarrhea and abdominal cramps.

Most healthy individuals are able to overcome the disease within a few weeks. However, immuno-compromised people have more difficulty and are at greater risk of developing severe, life-threatening illness. Immuno-compromised individuals are encouraged to consult their doctors regarding appropriate precautions to prevent infection. Cryptosporidium must be ingested for it to cause disease, and may be passed through other means than drinking water.

EPA required public water systems using surface water to conduct sampling for Cryptosporidium in source waters. This sampling is used to determine if additional treatment will be necessary to provide protection from microbials. Systems are placed in one of four categories (bins) based on their microbial results. The Newburyport Water Works has been placed in the lowest bin, meaning that no additional treatment will be required

Sampling conducted for a 2 year period ending in March 2010 (48 total samples collected) showed the presence of a single Cryptosporidium oocyst/L in one sample collected. All of the remaining samples were negative. These sample results are the reason for the placement of our water system in the lowest bin classification.

Water Quality Monitoring

Below is a list of regulated substances detected in your drinking water.

Substance	MCL	MCLG	Highest Level Detect	Range	Major Sources in Drinking Water
Fluoride (ppm)	4	4	1.2	0 - 1.4	Water additive which promotes strong teeth
Perchlorate (ppb)	2	N/A	0.39	0.13-0.39	Rocket propellants, fireworks, munitions, flares, blasting agents
Sodium (ppm)	None	None set	61	0-61	Naturally occurring deposits, road salts, water treatment chemicals.
Radium 226 pCi/L	15 pCi/L	0	0.6	0.35-0.60	Naturally occuring deposits
Radium 228 pCi/L	15 pCi/L	0	0.45	0.30-0.45	Naturally occurring deposits
Barium (ppm)	2	0	0.007	0 - 0.007	Discharge of drilling waste; discharge from metal refineries; erosion of natural deposits.
Nitrate (ppm)	10	10	1.19	0.93-1.19	Runoff from fertilizer use, leaching from septic tanks, sewage, erosion of natural deposits.
Gross Alpha Activity(pCi/L)	15	0	0.67	0.67	Erosion of natural deposits
Turbidity (NTU)	TT = 5.0 max	0	0.17	0.03-0.17	Soil runoff
	TT<0.3 in 95% of the samples	0	Not Applicable		
Total Coliform Bacteria	< 5% in all monthly samples	0	0		Naturally present in the environment

Trihalomethane and Haloacetic Acid from distribution system sampling.

Substance	MCL	MCLG	Running Annual Ave.	Range	Major Sources in Drinking Water
Total Trihalomethanes (ppb)	80	0	50.5	31.7 - 73.6	By-product of drinking water chlorination
Haloacetic Acids (ppb)	60	0	17.2	0.6 - 38.4	By-product of drinking water chlorination

Lead and Copper testing at the customer's home. (Sampling conducted in 2012)

Substance	Action Level	MCLG	90th Percentile	Range	Major Source in Drinking Water
Lead (ppb)	15	0	1	0 - 4	Corrosion of household plumbing systems, erosion of natural deposits.
Copper (ppm)	1.3	0	0.1	0.02 - 0.15	Corrosion of household plumbing systems, erosion of natural deposits, leaching of wood preservatives.

Secondary Contaminants

Substance	SMCL	MCLG	Highest Level Detect	Range	
Manganese (ppb)	50	0	24	15-24	Erosion of natural deposits

Table Key

ppm - Parts per million; one part per million is equivalent to $.01 in $10,000.
ppb - Parts per billion; one part per billion is equivalent to $.01 in $10,000,000.
MCL - Maximum Contaminant Level; the highest level of contaminant that is allowed in drinking water.
MCLG - Maximum Contaminant Level Goal; the level of a substance in drinking water below which there is no known health effects.
MCLGs allow for a margin of safety.
SMCL -Secondary Maximum Contaminant Level; These standards are developed to protect the aesthetic qualities of drinking water and are not health based.
Turbidity - Turbidity is a measurement of the cloudiness of the water. Low NTUs are a good indicator of the effectiveness of our filtration process.
NTU - Nephelometric Turbidity Units; a measure of the presence of particles in drinking water. Low NTUs is an indicator of high quality water.
TT - Treatment Technique; a required process intended to reduce the level of a contaminant in drinking water.
Action Level - The concentration of a contaminant which, if exceeded, triggers treatment or other requirements which a water system must follow.
pCi/L - Picocuries per liter (a measure of radiation)
* The EPA has established a lifetime health advisory (HA) value of 300 ppb for manganese to protect against concerns of potential neurological effects, and a one-day and 10 day HA of 1000ppb for acute exposure.

Cross Connections

A cross connection is a direct arrangement of a piping line, which allows the potable water supply to be in contact with a contaminant. Contamination is possible from either back-siphonage or backpressure. The most common residential cross connections are from items such as a lawn irrigation system or garden hoses connected to a hand held fertilizer sprayer or left lying in a pool or other contamination source.

The Newburyport Water Works has an active cross connection control program that is directed towards its commercial, industrial and institutional users to prevent the existence of unprotected cross connections. If residential users are concerned with the possibility that they may have cross connections in their homes, they are welcome to contact the Newburyport Water Works at (978)465-4466 for more information.

Frequently Asked Questions

What is the pH of Newburyport water? The average pH of the water in Newburyport's distribution system is 7.4.

Is Newburyport's water soft or hard? Newburyport's water is soft. The water will average 40 – 50 mg/L of hardness (2.3 – 2.9 grains per gallon).

What causes discolored water from my tap? Water main breaks, fire hydrant flushing or other disruptions of flow in the distribution system may cause temporary discoloration of water.

Does Newburyport add fluoride to the water? Yes, Newburyport does add fluoride to the water in correct amounts for dental health benefits.

WATER & SEWER COMMISSION
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Robert Cook
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WTP OPERATORS
Christopher Hood
Mark Collyer
Joseph Grande
Thomas Hegarty
Peter King
William Koppana
Matt Solazzo

Thomas Smolski, Superintendent
Daniel Lynch, Distribution Manager

Newburyport 2015 Rain Barrel Program

The City of Newburyport has partnered with the Great American Rain Barrel Company in Hyde Park, MA to offer rain barrels to residents at a discount to help conserve water and save money

Each UV protected polyethylene rain barrel is manufactured in the USA from a recycled shipping drum that stands 39" tall by 24" wide and weighs 20 lbs. empty with a wall thickness of 3/16", resulting in a rigid, heavy duty rain barrel that will last virtually forever. The barrel comes complete with overflow fittings, drain plug, screw on cover, and a threaded spigot with a choice of two ports to use with either a watering can or a garden hose. The rain barrel arrives with simple instructions for fast and easy installation. Newburyport is offering the Great American Rain Barrel in three colors; Forest Green, Earth Brown or Nantucket Gray at the low cost of $79 versus the retail price of $119.

To take advantage of this community program discount please go to:

http://greatamericanrainbarrel.com/c-103-newburyport.aspx

or email info@tgarb.com call (800)251-2352.

Barrels will be available for pick up on Thursday, June 25th, 5:00-7:00pm Crow Lane Recycling Center Newburyport, MA. Deadline to purchase: June 18st, 5:00pm.

The Great American Rain Barrel Company is a wholly owned subsidiary of a Mediterranean specialty food importing business. The barrels are recycled from 6o gallon shipping drums and distributed to homeowners nationwide. For information about The Great American Rain Barrel Company and their products please visit www.greatamericanrainbarrel.com.

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