

SECTION 4**FUTURE CONDITIONS**

Wastewater management planning must address both current and future needs. As Orleans grows in population, wastewater management needs will increase. Wastewater flows will increase as vacant lots are developed, as seasonal homes are converted to year-round use (or are occupied a greater percentage of the year), and as commercial development expands to serve the larger population. Annual average wastewater flows have been selected as the common denominator to project future wastewater needs.

4.1 FUTURE WASTEWATER QUANTITIES**4.1.1 Definition of Terms**

The term "current conditions" is intended to mean the general population, level of commercial activity and wastewater generation rates that existed in the middle of the 2000-2009 decade. The water consumption analysis, that has led to estimates of current wastewater volumes, is based on the average water use for the years 2002 to 2005. Given the relatively low growth rate and the year-to-year variability in the water use data, these "current" quantities may be appropriate through the completion of the CWMP.

For "future conditions", the following terms have been used:

Theoretical Build-out. The population and commercial activity associated with the ultimate development of Orleans to the fullest extent possible under current zoning and other regulations, regardless of economic issues.

Practical Build-out. The population and commercial activity associated with more realistic assumptions on the extent of build-out, factoring in such concerns as economic realities, other limitations on growth (such as infrastructure capacity), land protection efforts, and retention of estate properties.

Planning Horizon. A future population and level of commercial activity less than Practical Build-out that will be the basis for analyzing wastewater management options and for the design of whatever infrastructure may be recommended.

It is common practice to establish population estimates for these future milestones. However, given the large seasonal swings in population in Orleans and the importance of commercial activity (some of which is associated with growth in other towns), wastewater volumes have been used as the "measure" of future growth. It is possible to assign estimates of year-round and seasonal population once the future wastewater flows are determined. The estimates of wastewater flow are annual averages, without regard to how they will be treated and disposed of; some portion will continue to be handled in Title 5 systems, other portions will be collected and conveyed to satellite or centralized treatment systems. The projections of future wastewater quantities consider only the total volumes.

4.1.2 Theoretical Build-Out

The Town's GIS database was used to convert the Planning Department's lot-by-lot build-out assumptions into a projection of Theoretical Build-out wastewater flows. The result is summarized below:

Current Flows

Residential	608,000 gpd
Commercial, etc.	<u>171,000</u>
Total	779,000 gpd

Increase through Theoretical Build-out

Seasonal conversions and home expansions	164,000 gpd
New homes on existing or new lots	144,000
New accessory apartments in res. zones	115,000
New apartments in commercial zones	89,000
Commercial growth	<u>144,000</u>
Total increase	656,000 gpd

Theoretical Build-Out Flow **1,435,000 gpd**

The estimate for seasonal conversions and new homes is the result of an analysis of water use for all existing homes, taking into account numbers of bedrooms and seasonal status. The projected

increase is 26% of current residential wastewater flows. This figure represents the more intensive use of existing properties, and is independent of the number of new homes that might be built.

The estimate for new homes and apartments is based directly on the Planning Department's lot-by-lot assessment of where such dwelling units are allowed under the zoning bylaws. It includes 931 new residences, 1,490 new accessory apartments and 901 new apartments in the commercial zones. For town-wide purposes, this estimate is based on a single figure for residential water use per home, two-thirds of that figure for apartments, and one-half for accessory apartments.

The increase in commercial flows was assumed to be proportional to the overall increase in residential flows.

The projected wastewater flow at Theoretical Build-out represents an 84% increase over current flows.

4.1.3 Practical Build-Out

After development of the Theoretical Build-out projections, the Planning Department challenged all for the pertinent assumptions to inject a degree of "realism". The result is summarized below:

Current Flows

Residential	608,000 gpd
Commercial, etc.	<u>171,000</u>
Total	779,000 gpd

Increase through Practical Build-out

Seasonal conversions and home expansions	61,000 gpd
New homes on existing or new lots	112,000
New accessory apartments in res. zones	25,000
New apartments in commercial zones	44,000
Commercial growth	<u>36,000</u>
Total increase	278,000 gpd

Practical Build-out Flows **1,057,000 gpd**

The estimated increase for seasonal conversions and home expansions was reduced from 26% to 10% of current wastewater flows. This latter figure is thought to better represent the actual experience in seasonal conversions over the past several years, and the fact that some home expansions may not involve much, if any, increase in flow.

The estimate for new homes and apartments is based on the Planning Department's judgment that only 90% of the potential new residences will ever be built, only 25% of the potential accessory apartments will be constructed, and 50 to 60% of the commercial-zone apartments will be developed. This translates to 838 new residences, 373 new accessory apartments, and 509 new commercial-zone apartments.

For commercial flows, the revised projection is based on an analysis of building permits for new or expanded buildings. The projected commercial wastewater flow at Practical Build-out represents a 21% increase over current flows, or about one-half of the percentage increase for residential flows. (By comparison, the same percentage increase was used for both residential and commercial in the Theoretical Build-out analysis.)

The projected wastewater flow at Practical Build-out represents a 36% increase over current flows.

Table 4-1 summarizes the principal assumptions behind the Practical and Theoretical Build-out analysis. Figure 4-1 illustrates the projections graphically. The February 2007 draft Needs Assessment Report contains some of the details associated with the projections, both town-wide and in the Village Center.

4.1.4 Planning Horizon

Whether it is the Practical or the Theoretical Build-out projection, Town officials have expressed the strong sense that neither condition will be reached within the traditional 20-year design life of the prospective wastewater facilities. Therefore, it is appropriate to select the planning horizon (in terms of both a date and the associated degree of growth) to better reflect intermediate-term needs. Three techniques were used to arrive at the planning horizon flows, as follows.

TABLE 4-1

SUMMARY OF ASSUMPTIONS USED IN BUILD-OUT ANALYSIS

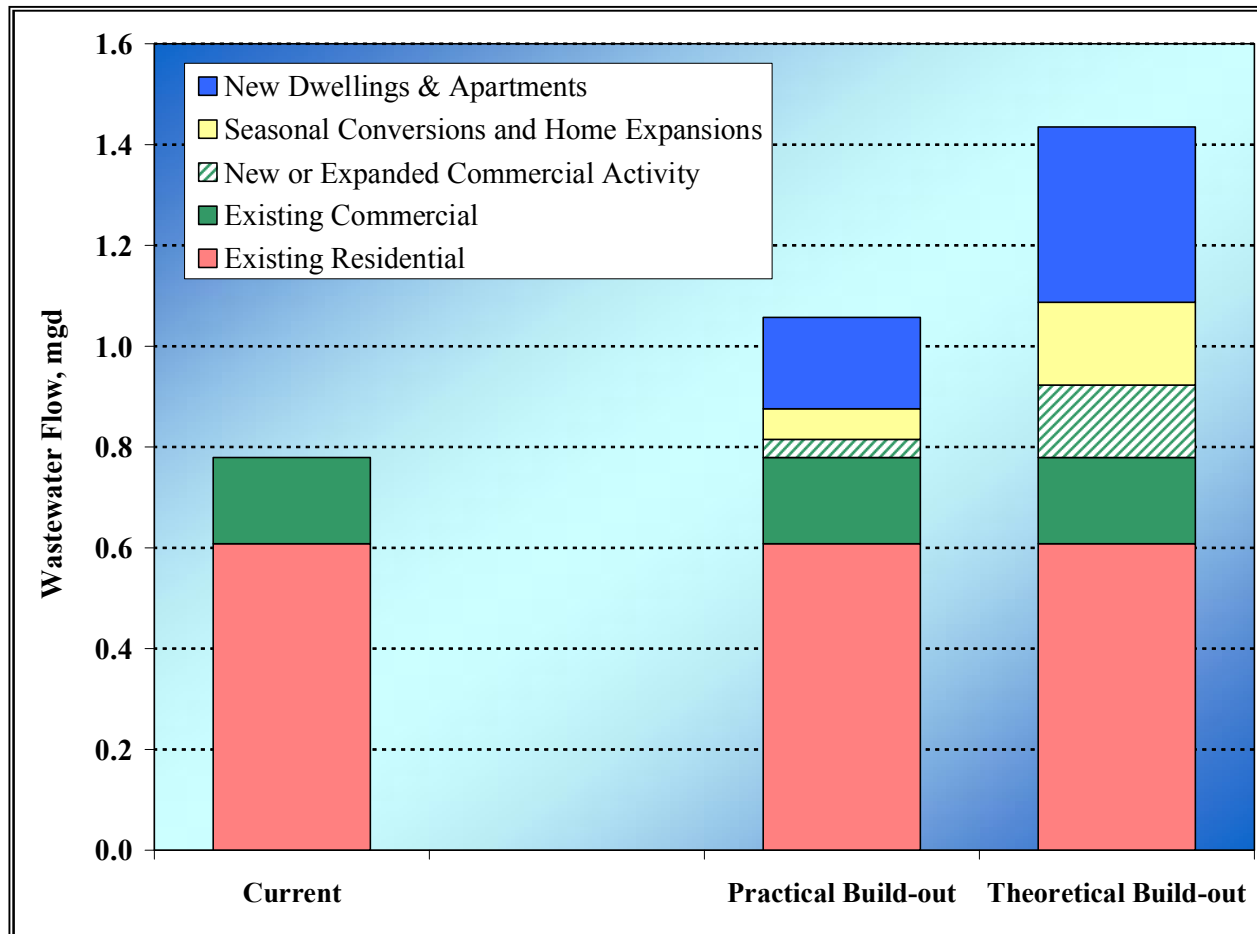
SECTOR	PRACTICAL BUILD-OUT	THEORETICAL BUILD-OUT
Residential		
Seasonal Conversions and Home Additions	10% Increase in Per-Home Flow	26% Increase in Per-Home Flow
New Dwelling Units		
Residences	838	931
Per-Unit Flow, gpd	134	155
Accessory Apts. in Residential Zones		
Per-Unit Flow, gpd	67	77
Apts. in Commercial Zone		
Per-Unit Flow, gpd	86	99
Commercial		
Percent Increase Over Current	21%	84%
Overall Increase in Flow		
(Over Current)	36%	84%

Note: See text for definitions
 Source: Orleans Planning Dept.

Method 1. Select a date, and estimate how much of the Practical Build-out will occur by then, assuming a straight-line increase and current trends.

Recent experience has indicated a growth rate of 53 dwelling units per year. If Practical Build-out represents about 2,000 new dwelling units, then it would take 38 years to reach Practical Build-out. The 24-year interval from 2006 to 2030 (the end of the 2010-2030 planning period) represents about 63% of the time to build-out. Assuming that 63% of the increase in flow would occur in the next 24 years, this approach leads to an increased flow of 175,000 gpd, and a planning horizon flow of 954,000 gpd.

**FIGURE 4-1
WASTEWATER FLOW PROJECTIONS
AT BUILD-OUT**



Note: See text for definitions
Source: Orleans Planning Dept.

Method 2. Select a date, and estimate how much of the practical build-out will occur by then, assuming build-out will extend further in time as "easy" development occurs first and "difficult" development occurs at an increasingly slower rate.

If current trends (53 dwelling unit per year) slow down over time, perhaps it will take 60 years (instead of 38) to reach practical build-out. With that thought, perhaps 55% of the increase will occur in the first 40% of the planning period (that is, will occur by 2030). This approach leads to an increase in flow of 153,000 gpd, and a planning horizon flow of 932,000 gpd.

Method 3. Consider other limitations on public infrastructure and design wastewater facilities for the same "breakpoint".

This approach is much more subjective and requires the analysis of each component of public infrastructure. That analysis has not been conducted. For discussion purposes, suppose that parking and traffic limit growth and economic activity in Orleans to the flow equivalent of a 25% increase over current population and commercial activity. For this hypothetical example, one might select a planning horizon flow of 973,000 gpd. This figure would be reached at the point where the other infrastructure becomes limiting, and not necessarily at 2030.

These three approaches yield the following flows at the planning horizon:

Method 1:	954,000 gpd	(22% higher than current)
Method 2:	932,000 gpd	(20% higher than current)
Method 3 (example only):	973,000 gpd	(25% higher than current)

Figure 4-2 illustrates graphically the trends associated with each method. After review of these data and graphs, the Wastewater Management Steering Committee selected a planning horizon flow of 950,000 gpd.

4.2 POPULATION PROJECTIONS

Analysis of water use and demographic data by Town staff indicates that Orleans' current population is approximately 10,700 on an annual average basis. This figure represents the average of all months of the year, including about 6,000 in January and about 22,000 in July and August. While peak summer populations and associated wastewater flows will determine the sizing of wastewater facilities, this needs assessment first considers how the annual average population will change through build-out and at the planning horizon.

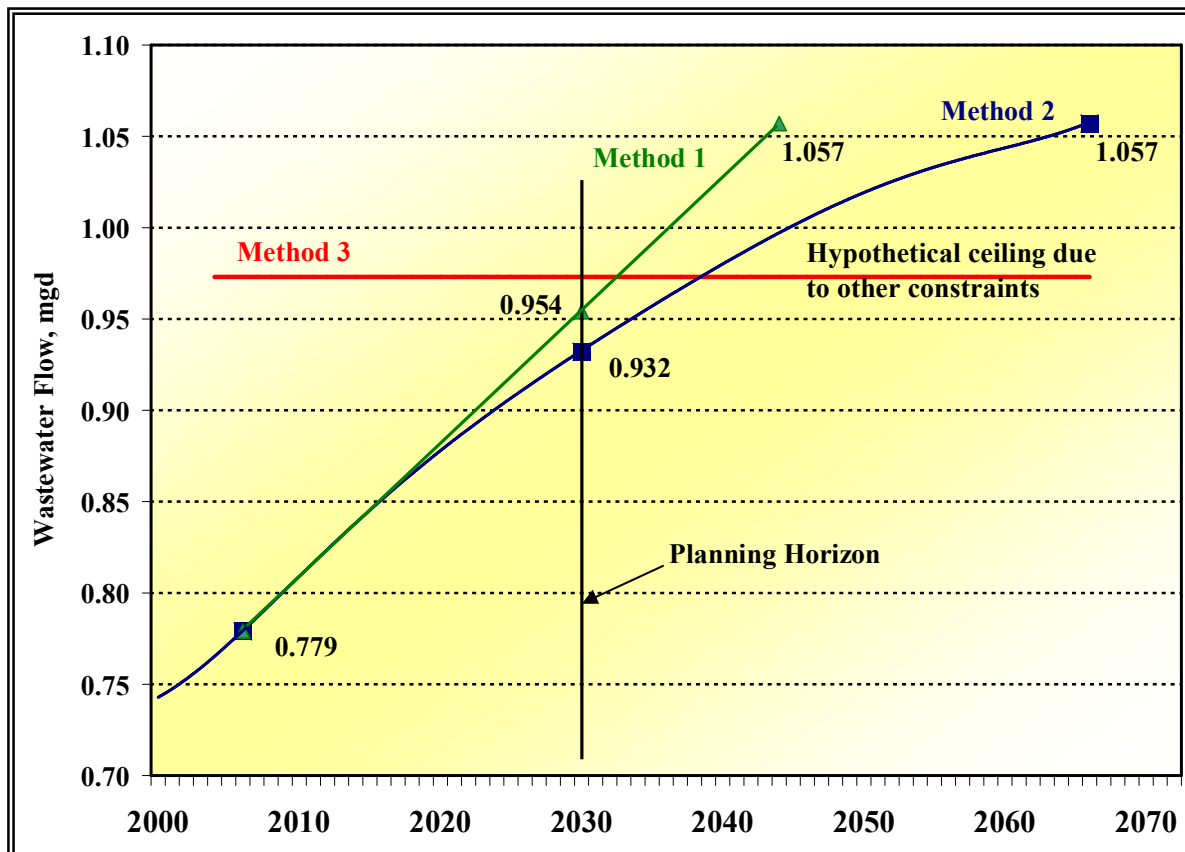
Assuming that the per capita water use and wastewater flow will not change over time, the wastewater quantities projected above can be converted to population estimates, as follows:

Planning Horizon	13,500 (26% increase over current)
Practical Build-out	15,000 (40% increase over current)
Theoretical Build-out	19,700 (84% increase over current)

As part of the evaluation of alternatives, summer peak flows will be estimated using peaking factors derived from Town water pumping records, with consideration given to the "flattening" of the population distribution by month. That is, a 26% increase in equivalent annual population may mean a larger percentage increase in year-round population and a smaller percentage increase in peak summer population.

FIGURE 4-2

**DETERMINATION OF WASTEWATER FLOW
AT END OF PLANNING HORIZON**



Note: See text for definitions
Source: Orleans Planning Dept.

4.3 FUTURE WASTEWATER NEEDS

Future (planning horizon) wastewater flows have been computed for all lots in Orleans, and have been included in Table 4-2, the summary of future wastewater needs. Table 4-3 includes a tabulation of wastewater flows at the planning horizon for each sub-watershed.

Except for estuary protection, the increases in wastewater flow associated with each needs category reflect an 8% increase in commercial flows and a 26% increase in residential flows. With respect to nitrogen loading to embayments, these growth percentages also apply but a second factor is included. Since the nitrogen-based TMDL's are absolute ceilings, nitrogen control must be provided for 100% of the increase in wastewater nitrogen load in addition to the reduction in current load. Therefore future flows associated with this need category reflect a greater percentage increase over current flows than indicated for the other needs categories.

4.4 "NO ACTION" ALTERNATIVE

It is instructive to consider the nature of Orleans and its environment in the scenario where none of the documented wastewater management needs are formally addressed; that is under the "no action" alternative.

The sanitary needs assessment has identified 73 properties where significant Title 5 variances have been granted over the last 11 years. These are properties where an off-site wastewater solution, if it were available, might be desirable for the property owner and/or mandated by the Board of Health. Although the situation might be incrementally improved with off-site solutions, there are no demonstrable public health problems associated with these systems. The systems with significant Title 5 variances over the last 11 years represent less than 2% of the developed properties in Orleans, and, projecting to 20 years might increase that number to 4% of all developed properties. Given the limited number of these properties, lack of off-site wastewater solutions would not be expected to create serious unhealthful or nuisance conditions.

Continued use of on-site wastewater disposal for properties in the Zone IIs of public water supply wells would result in slightly more nitrates and other contaminants reaching the wellhead

**TABLE 4-2
SUMMARY OF FUTURE NEEDS IN ALL CATEGORIES**

NEEDS CATEGORY	WATERSHED				TOWN-WIDE
	PLEASANT BAY	NAUSET SYSTEM	ATLANTIC OCEAN	CAPE COD BAY	
Sanitary					
Number of Parcels	48	79	5	66	198
Current Flow, gpd	16,100	63,500	3,900	78,900	162,400
Future Flow, gpd	19,600	77,500	4,800	96,300	198,200
Water Supply Protection					
Number of Parcels	0	0	0	0	0
Current Flow, gpd	0	0	0	0	0
Future Flow, gpd	0	0	0	0	0
Surface Water Protection (ponds)					
Number of Parcels	50	9	0	0	59
Current Flow, gpd	5,800	2,400	0	0	8,200
Future Flow, gpd	9,800	3,300	0	0	13,100
Surface Water Protection (estuaries)					
Number of Parcels	1,480	790	0	220	2,490
Current Flow, gpd	200,000	134,000	0	52,000	386,000
Future Flow, gpd	277,000	177,000	0	87,000	541,000
Convenience and Aesthetics					
Number of Parcels	29	39	6	40	120
Current Flow, gpd	9,600	36,500	4,700	53,900	104,700
Future Flow, gpd	11,700	44,500	6,100	72,000	134,300
Economic Development					
Number of Parcels	0	5	0	5	10
Current Flow, gpd	0	0	0	0	0
Future Flow, gpd	0	8,600	0	8,600	17,200
Total					
Number of Parcels	1,545	837	11	257	2,644
Current Flow, gpd	213,000	170,000	8,600	101,600	493,200
Future Flow, gpd	295,000	230,000	12,000	156,000	693,000

Note: Town-wide totals are additive across the row. Totals by major watershed are not additive by column. The category total by watershed accounts for parcels that have more than one need. The numbers of parcels does not reflect possible subdivisions.

Source: See text.

TABLE 4-3

**ANNUAL AVERAGE WASTEWATER QUANTITIES BY WATERSHED
AT PLANNING HORIZON**

Watershed	# Parcels	Wastewater Flow, gpd		
		Residential	Commercial	Total
Areys Pond	65	8,500	500	9,000
Atlantic Ocean	155	22,000	6,100	28,100
Baker's Pond	11	1,200	-	1,200
Barley Neck	170	22,000	-	22,000
Boat Meadow	13	100	14,600	14,700
Crystal Lake	67	6,100	1,200	7,300
Deep Pond	21	2,400	-	2,400
Gould Pond Well ORL	46	6,100	-	6,100
Kescayogansett Pond	77	8,500	1,200	9,700
Kescayogansett River	13	1,200	-	1,200
Kescayogansett Stream	18	600	100	700
Little Namskaket	346	62,200	13,400	75,600
Lower River	220	28,100	-	28,100
Meetinghouse Pond	333	51,200	9,800	61,000
Multiple watersheds	13	-	-	
Namequoit River	147	20,700	-	20,700
Namskaket Creek	289	36,600	28,100	64,700
Nauset Harbor	638	85,400	500	85,900
Paw Wah Pond	112	13,400	1,200	14,600
Paw Wah Pond Bog	12	1,200	-	1,200
Pilgrim Lake	61	7,300	2,400	9,700
Pleasant Bay	429	57,300	1,200	58,500
Pochet Neck	209	28,100	-	28,100
Pochet Neck Stream	153	22,000	-	22,000
Quanset Pond	44	9,800	-	9,800
Quanset Pond Bog	6	500	-	500
Rock Harbor	328	57,300	39,000	96,300
Sarah's Pond	63	8,500	-	8,500
Shoal Pond	34	4,900	-	4,900
Tar Kiln Stream	35	3,700	600	4,300
The Horseshoe	11	1,200	-	1,200
Town Cove	975	119,600	89,100	208,700
Twinings Pond	50	6,100	-	6,100
Uncle Harvey's Pond	16	2,400	-	2,400
Uncle Seth's Pond	23	4,900	-	4,900
Upper River	150	20,700	100	20,800
Well 7 Well ORL	57	9,800	-	9,800
Total	5,410	741,600	209,100	950,700

than would occur with wastewater collection, treatment and disposal outside the Zone II. The analysis reported herein, however, indicates the continuation of current on-site disposal practices posed no significant risk to the water supply.

With respect to surface water protection, failure to address excessive nitrogen loading to estuarine waters will allow the currently observed degradation to continue and worsen. The degradation that has already occurred and been documented in Pleasant Bay could lead to sharply reduced fishing and swimming, and the eventual decline in property values. Given the great importance of coastal water quality in the Town's character and economy (of great value to both year-round and seasonal residents), lack of actions to control nitrogen loading could have very serious long-term impacts on the very resources that define the Town. With the issuance of nitrogen-based TMDLs, an enforcement mechanism will be in place that could be used by DEP to require nitrogen control. Orleans' failure to act in that setting will expose the Town to serious legal penalties and associated financial impacts. For some of Orleans' freshwater ponds, failure to remove phosphorus sources will appreciably accelerate water quality degradation.

By definition, wastewater needs associated with convenience and aesthetic factors do not pose substantive risks to the town if they are not addressed with off-site solutions.

The Town of Orleans intends to develop a growth-neutral wastewater management plan that neither restricts nor promotes growth different than allowed under current bylaws and regulations. Therefore, failure to implement wastewater management solutions should not impact economic growth. However, as new development occurs on lots that have more development challenges, the absence of public wastewater infrastructure could result in more I/A systems, more Title 5 variance requests and more Title 5 monitoring and compliance problems than would occur if public wastewater facilities were constructed. With respect to 40B housing, failure to provide off-site wastewater management capacity could restrict the options for affordable housing developers and conceivably create an impetus to locate such projects in less densely developed areas of town.

The "no action" alternative is explicitly contrary to the Orleans Comprehensive Plan. The Comprehensive Plan, as adopted on December of 1995 and amended in October 2006, sets forth the following explicit goals:

- To preserve and improve the ecological integrity of fresh and marine waters.
- To maintain coastal water quality that allows fishing, shellfishing, and/or swimming in all three estuaries, and to protect those coastal ecosystems which support shellfish and finfish habitat.

Inaction related to the documented needs to protect ponds and estuaries is directly contrary to these important Comprehensive Plan goals.

In some areas of wastewater need (sanitary/public health, water supply protection, convenience/aesthetics and economic development), continuation of current practices should not pose significant environmental or public health risks to the Town. With respect to protection of surface waters, however, the ramifications of "no action" would be severe. These impacts include:

- degradation of fisheries;
- impairment of water clarity and associated deterioration to swimming and other water contact sports;
- reduced opportunities for recreational and commercial shellfishing;
- floating algal mats and associated odor and visual impact;
- reduction in property values; and
- negative impact on the tourism economy.

In that the impacted resources are part of the very fabric of life in Orleans, these documented needs for surface water protection warrant serious concerted attention.