

Evaluations and suggestions* about storm water and septic tank management among residents of Nags Head Acres, Nags Head, NC

*during Spring 2013



Dear Residents of the Nags Head Acres subdivision,

Between January and May 2013, a team of researchers led by Dr. Christine Avenarius, Associate Professor of Anthropology, interviewed residents in your neighborhood regarding storm water management issues. The goal of the project was to gather your voices and bring your experiences, observations, concerns, and suggestions to the attention of you and your neighbors, and public officials. Our team of ECU anthropologists spoke with one third of all households in the subdivision. We also talked to the town engineer, town planner, and the town manager. In order to capture viewpoints, we asked residents of Nags Head Acres a series of open-ended questions allowing a range of opinions to surface. We also shared photographs depicting standing water in ditches, driveways, and yard to understand levels of tolerance for particular circumstances. We analyzed transcripts of these conversations by assigning codes to denote recurring themes. We looked for similarities and differences between residents' responses, and accounted for frequency and co-occurrences of these responses. The following is a report of findings addressing particular points of discussion and trends revealed in the transcripts of our conversations with neighbors.

The main findings and suggestions are posted in the next three pages.

For further detail, please continue reading or select a specific section of interest from the table of contents. You find an explanation of our research methodology and a detailed account of neighbors' observations about the standing water, their tolerance levels, and their explanations of causes. We also present viewpoints about the relationship between standing water and septic tank. The last section of the report discusses suggestions for remedies and review opinions about financing a change of practices. Throughout this report we intersperse related comments contributed by the town engineer for Nags Head, Mr. David Ryan.

We sincerely thank all participants for their time, energy and willingness to engage in conversations with us and wish everyone a pleasant reading experience.

Sincerely,

Christine Avenarius and Jessica Handloff

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Summary of Nags Head Acres residents' viewpoints and suggestions

In recent years, heavy rainfalls occasionally brought several days of standing water to some of the driveways, yards, swales, and roads in the Nags Head Acres subdivision in Nags Head, NC. As a result, specific street sections became temporarily impassable. In most incidents, the water receded after a few days. However, the higher frequency of standing water events and the larger volume of water caused many residents to wonder if the conditions have reached a breaking point that calls for modification of established residential practices in respect to storm water management. Neighbors have asked themselves, their fellow neighbors, and the town manager and town planners what can be done to remedy events of standing water and prevent an escalation of similar water events in the future.

Method. A team of three students led by Dr. Christine Avenarius, Associate Professor of Anthropology at East Carolina University, talked to residents of Nags Head Acres (NHA), the town planner and the town engineer about storm water management practices. We asked a series of open-ended questions to collect experiences, observations, concerns, and suggestions. 30 households participated. Both this summary and the detailed report feature representative quotes that capture reoccurring statements among neighbors. Although we found few differences in opinion by gender or age, variances exist between residents who grew up or spent more than half their lifetime in Dare County and residents who have moved to Dare County after living and working elsewhere in the US.

Main concerns. More than 80% of participating neighbors voice concern about increased mosquito populations and diseases that the children who play nearby might contract: *"The mosquitoes are rampant when water stands."* In addition, many residents wonder about the relationship between standing water and septic tank management system in light of the higher water table and an increase in population density throughout most neighborhoods of Nags Head: *"If the flooding continues, we will have a septic tank problem."*

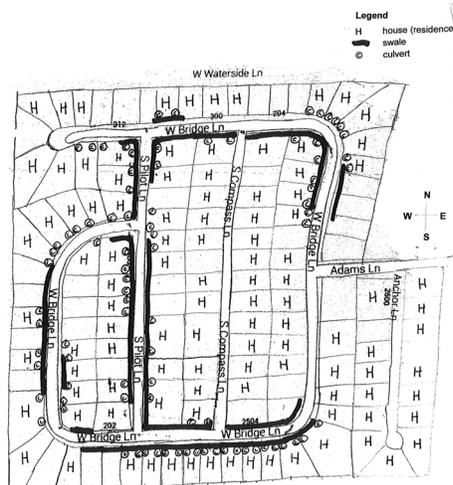
Further probing revealed that the majority of participants of this study have encountered no problems with their current septic systems thanks to town's Septic Health Initiative Program. About 70% of residents we interviewed communicate wishful thinking when it comes to small central sewage systems like those implemented in the Ocean Acres subdivision in Kill Devil Hills or the Nags Head Village. They see it as a potential remedy for further complications from standing water, a higher water table, and future septic tank failure. However, few neighbors think a switch to localized central sewage units is feasible because they anticipate an increase in operation costs.

Cost concerns also stand out as the most salient feature among the statements about the acceptable length of standing water in driveways and swales. There is widespread agreement that costs for neighborhood wide storm water management remedies should be kept low. Few residents welcome additional taxes or fees: *"Depends on the cost. I don't want any more fees."*

Neighbors’ explanations and suggestions. Most residents consider the density of built structures throughout the town of Nags Head to be responsible for the increasing obstructions to storm water outflow and the higher water table. A map of the current groundwater depth measurements is posted in the detailed portion of this report. While many people consider the character of the residential areas of the barrier island outside the tourist season as rather quaint and ‘rural’, the density of built structures throughout the beach towns qualify them as an ‘urban’ area. The amount of impervious structures has indeed contributed to limited options for water dissipating into the sand. This is not a new discovery: *“In the 1970s the water was standing there already.”* However, the volume of structures and the standing water is a recent development: *“What’s responsible for the standing water? Real simple: there’s nowhere for it to go.”*

Residents’ reactions to the problem of standing water extend from outrage to indifference. Neighbors who don’t live near any ‘wet spots’, repeatedly remark: *“I go the other way when there is standing water in the road. That’s all there is to it.”* Based on literature research and comments by David Ryan, the town engineer, we learned that the neighborhood functions as a joint system. Even unaffected neighbors contribute to the problem because properties with impervious structures influence the flow pattern of the water. The water may flow away from a specific property, but finds itself stopped in other areas of the neighborhood.

Most participants mention swales, culverts and drainage pipes when discussing remedies for standing water. However, residents disagree about the usefulness of swales and culverts. Opinions range from a call for more swales and culverts to refusals to have swales or culverts put in because their functionality is questioned: *“I covered up the culvert under my driveway because they don’t work.”* In addition, many participants consider the deeper swales an eyesore. Overall, longtime residents are more supportive of swales and culverts than residents with shorter residence periods. Town engineer David Ryan, explained that filling of ditches/swales/driveway culverts removes the ability to intercept and collect roadway runoff as well disrupting neighborhood drainage flow patterns,. The following map sketches all currently maintained swales and culverts in the neighborhood and shows that there are 2 ½ times more properties without swales than property with swales. You can see a larger image of the map on page 14.



The differences in opinions about best practices for the maintenance of spaces without housing structures also extend to choices for yard design, including lawn maintenances and plants. In many instances the aesthetics of the property is a decisive factor: *“We cut down a lot of trees. We couldn’t walk the backyard.”* However, we encountered many residents, who express willingness to plant more trees as long as it is not pine trees, since their fallen needles are considered a nuisance and residents question their survivability in this environment. Similarly, many participants voice interest in supporting aesthetically pleasing swale installation. They also suggest to either clean or replace the drainage pipe that links the neighborhood with the swales along the Hwy 158 bypass and from the bypass to the designated ocean outfall.

Conclusion. Based on our collection of opinions and evaluation of practices we close with two lists that capture the most favored suggestions. For additional information, please consult the detailed report below.

Remedies that NHA residents consider adoptable on private properties:

- Plant additional trees with roots that soak up water
- Create aesthetically pleasing swales: gentle slopes, not deep cuts
- Maintain culverts and/or open neglected culverts or create new culverts under driveways
- Use pervious materials for any new driveway enlargements or additions
- Use rain barrels in addition to wells for the water needs of lawns and plants

Remedies that NHA residents suggest for the town administration:

- Explore the drainage pipe connection between the neighborhood and the bypass, eventually leading to ocean outfalls
- Facilitate expedited permits for new swale creation
- Assist in tree planting and rain barrel programs (e.g. loan programs, etc.)
- Continue the septic tanks assistant programs

Detailed Report of Findings

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A note on our methodology for collecting and analyzing neighbors' viewpoints

We were able to speak with at least one member of 30 households within the Nags Head Acres subdivision. Together these participants represent roughly one third of all occupied houses in the neighborhood. The total number of lots in the main section of Nags Head Acres that contain a house is 92. The number of houses surrounding Anchor Lane is 14. There are a few houses that are currently not inhabited. Participants included 17 men and 13 women, which doesn't resemble an even distribution, but is not entirely unbalanced either. Participation in this project was entirely voluntary. We would have loved to talk to more residents, yet despite repeated phone calls to residents and walks through the neighborhood to introduce our mission and ourselves we could not solicit more responses. However, if any of you who read this report would like to voice your opinions now, please don't hesitate to contact us. We will meet with you and include your viewpoints in the next edition of our report.

The majority of participants, three quarters, are over 45 years of age. We also computed the length of time a participant has lived on the Outer Banks, i.e. in Dare County, making a distinction between 14 neighbors who were either born in Dare County or have spent more than half their lifetime in Dare County, and 16 neighbors who have spent less than half their lifetime in the County. We created these associations to test if length of experience with storms and storm water events has an influence on opinions and suggestions. Since the number of Dare born residents in the neighborhood that were willing to talk to us was rather small, 5 of 30 neighbors, and their opinions didn't differ significantly from the opinions of neighbors who spent more than half their lifetime in Dare County, we decided to merge their statements as part of a single group.

Neighbors who participated in face-to-face conversations with us will recognize some of the topics we review in this report as part of our conversations. Neighbors who were unable to participate in the conversation might like to know that the findings about opinions and wishes presented here are derived from open-ended questions. Our conversations were not based on questions that asked participants to either agree (yes) or disagree (no). Instead we presented questions that required neighbors to express their opinions and offered pictures and sorting cards to aid the recollection of past experiences with storm water events and to elicit suggestions for improvement. Hence the insights presented here are topics that your fellow neighbors have brought up themselves. While everyone had different things to say and no conversation resembled the other, we were able to detect reoccurring themes across conversations.

We identified patterns among the responses to the open ended questions by reading the transcripts of each of the 30 conversations we conducted. While reading, we labeled content as it appeared, i.e. we assigned a suitable keyword for each new idea, suggestion or thought that a participant mentioned. The next step was to compare all the key words that we had used to label content. We noticed that some key words were different but meant the same. We proceeded to streamline the use of key words and replaced similar terms with the same label throughout all 30 interview transcripts. Finally, we tallied the number of frequencies of re-occurrence among specific keywords. We also looked for co-occurrence of keyword combinations within the space

of two to three sentences, i.e. we established which two or three keywords frequently occurred together as part of the response to a question. The graphics that we have included throughout this report reflect results from this procedure. Words that were mentioned most frequently appear in the largest font. Their location within a graphical display indicates their relationship to the other terms that were mentioned in response to a specific topic.

Throughout this report you will also see a selection of direct quotes by your fellow neighbors. We have selected these statements from the 30 scripts of conversations. Whenever we found content repeated by at least 10 of the 30 participants, the related statement made it onto our list of reoccurring quotations. The statements that you see in this report are taken from these lists of quotations with similar content. The final selection for inclusion in this report is a subjective choice by the authors to capture the sentiments of at least one third if not more participants of this project. However, we hope that you find these statements as “telling” as we do and enjoy reading this report. It reflects the findings we derived from our process of understanding what neighbors of Nags Head Acres think about storm water and septic tank management issues. We also relate how these findings differ by gender, age, location of residence within the neighborhood, and proportion of lifetime spent in Dare County.

Neighbors’ reaction to standing water in driveways and ditches

The initial question in each of our conversations was: “What comes to mind when you hear the phrase ‘water issues in the neighborhood’?” In response, almost everyone brings up the unsightliness of the flooded corner lots, especially near the empty lot at 2620 W. Bridge Lane. More than 80% of participating neighbors voice concern about increased mosquito populations and diseases that the children who play nearby might contract. Women mention mosquitoes more often than men, yet men wonder about diseases from leaking septic water more often than women. Only a few residents are afraid that their properties might be damaged as a result of standing water.

Here is a selection of representative statements from neighbors that each got mentioned by at least 10 people. The wording differs from participant to participant, but the content is similar in at least 10 of the 30 interviews.

“The mosquitoes are rampant when water stands.”

“I fear mold and allergic reaction from the standing brown brackish water.”

“Worst area in the neighborhood is at the southern end where ditches fill up and deposits from septic contents rise.”

“In the long term, health inspections might find out that things are not good.”

Figure 1: Graphic display of word frequencies that reflect associations about standing water

Mosquitoes Ponding Might Cause Property Damage Concerned About Personal/Environmental Health Deposits From Septic Tank

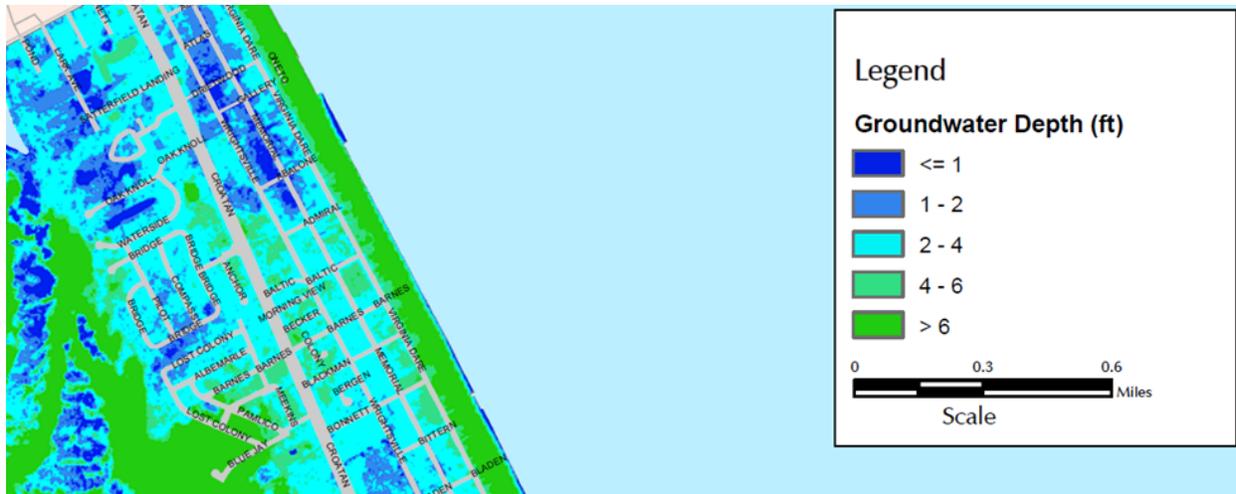
To gauge the acceptability of standing water we asked participants to look at nine pictures of different levels of flooding of ditches, driveways and streets during conversations. Tolerance levels vary from some neighbors finding no incidence of standing water acceptable to neighbors identifying only two of nine pictures as worrisome. However, all neighbors pick the same two pictures as places that need remedies. These pictures depict a) a driveway with standing water that measured almost a foot high at the garage door of the property and b) the brackish-brown, rusty colored water standing in a ditch at the southern corner of the neighborhood. All other pictures of varying degrees of water levels in driveways and swales receive mixed reviews.

Responses were even more varied in respect to our question about the length of time that standing water in driveways is acceptable. At the opposite ends of the distribution, 6 neighbors find standing water unacceptable for any length of time and another 6 neighbors either tolerate more than 7 days of standing water or state that their level of acceptance is tied to the severity of the preceding storm. Yet another 6 neighbors have no misgivings when the water stands between 3 to 5 days. The remaining 12 neighbors, the biggest proportion of residents with a similar opinion, find up to 2 days of standing water acceptable. Although we expected to find a clear pattern of acceptance based on length of residence in Dare County, this hunch could not be confirmed. Residents who spent more than half or all of their lifetime in Dare County are as likely to condemn standing water for any length of time as residents who spent lesser amounts of time in the area.

What explains the standing water?

Most neighbors are in agreement that while some years see more rainfall than others, overall it doesn't seem to be raining a lot more than it did ten or fifteen years ago. Yet the same people notice that there is more water standing for longer periods of time than in previous years. We asked participants to give us an explanation for the increase in the volume of standing water and received a range of comments about the causes. They can be summarized as the realization that storm water issues are a result of impervious ground covering structures and/or vegetation removal that are a byproduct of urban development. The following map shows the current ground water depth measurements in the northwestern neighborhoods of Nags Head.

Map 1: Ground water table in the northwestern neighborhoods of Nags Head, NC



A more detailed look at neighborly reflections shows eight themes for explanations that range from the basic realization of water flow patterns and historic changes, to explorations of the role of property outfittings such as swales, culverts, graded driveways, plants and trees.

Figure 2: Graphic display of word frequencies that explain causes of standing water

New Construction
Ditches Don't Work
No Place to Go
High Water Table
Fresh Pond Not Pumped
Filling Swales and Culverts

Explanation 1: Water has nowhere to go

At the surface, most everyone offers a simple statement:

“Water has to go to its source. It reaches its own level.”

“What’s responsible for the standing water? Real simple: there’s nowhere for it to go.”

Explanation 2: Past practices still affect us today

In terms of historic perspectives, it is not surprising that participants who have spent more than half their life time in Dare County, have the most comments to offer. Residents who have lived and worked in the area since the 1970s remark that even then, they witnessed standing water. However, given the low population density in the beach areas of Dare County at the time, the standing water affected fewer residents. The low density called hardly anyone to action, which

might explain the assumption shared by several people that the drainage system within the Town of Nags Head was not put in correctly or without a vision for a more densely populated area.

“In the 1970s the water was standing there already. What amazed me, people said its sand, it’ll soak in.”

“It has to do with the way the town developed the lots in the first place. It didn’t drain very well back then either. But there were fewer people.”

“Water maze was put in wrong. Some time in the early 1970s it must have gone wrong.”

Most people accept that weather patterns are cyclical. Long-term records show that the 1980s, an early period of the building boom in Dare County beach towns, enjoyed a relatively dry weather pattern that made drainage issues literally less visible. In recent years the weather has oscillated between wetter and less wet periods. Regardless of any future prognosis of rainfall patterns, the density of built structures in Dare County has increased and contributes to the need for improved storm water retention practices.

Accounts of increases in new construction can also be found in neighbors’ reminiscence about the structures that have disappeared over the course of the years of development. Some neighbors miss the waterslide that used to be in place of the current Dunkin Doughnuts strip mall. Others wish that the Food Lion shopping area had become a neighborhood park for the surrounding subdivisions. Another location that invited historic comparisons is the Fresh Pond at the border between the Town of Nags Head and the Town of Kill Devil Hills.

Explanation 3: Pumping Fresh Pond has stopped

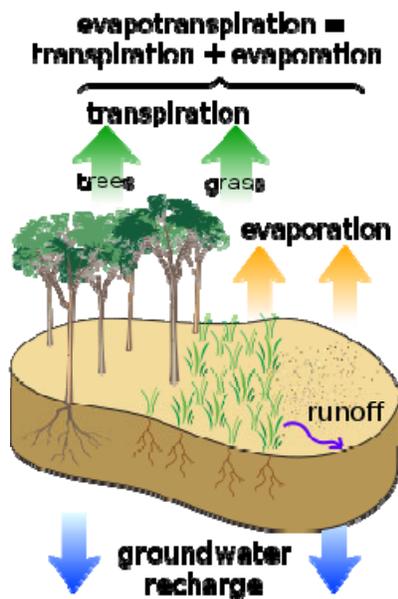
The discontinued use of pumps at the Nags Head Fresh Pond is a frequently mentioned culprit for the higher water table that has made rainwater stand longer on lawns, in driveways, and on street surfaces. Longtime residents know that Nags Head used to get fresh water from the 8th street pond at the border between Nags Head and Kill Devil Hills. The pumps were sold when this practice was abandoned for cost saving reasons because obtaining water from the Dare County wide source proved to be cheaper than relying on Fresh Pond water. Since then the water table of the pond has not been artificially lowered.

There is evidence that pumping Fresh Pond facilitated a temporary lowering of ground water levels. Town engineer David Ryan introduced us to a scientific article titled “Hydrology of a Regressive Barrier Island Segment, Bodie Island, North Carolina.” Geologists Richard Whittecar and Janet Salyer Emry from Old Dominion University in Norfolk, VA wrote it in 1992. After analyzing soils and water flow in the vicinity of Fresh Pond the authors come to the conclusion that the specific characteristics of this barrier island make groundwater flow paths much more complicated than predicted by simple models. The thickness, range, and permeability of the soil strata on the island vary within a few hundred feet. There are shallow peat-and-mud beds and the sand-and-mud beds.

Nevertheless, they say that “if all works correctly in case of a surplus of precipitation, groundwater seeps from the island’s center towards the margins, passing beneath dunes and through ponds, eventually to surface in tidal wetlands or along the beach zone” (Whittecar and Emry 1992:196). Rainfall events usually have very little impact on the water table because of evapotranspiration, a combination of transpiration (which is more pronounced in the summer time) and evaporation,. The following graphic illustrated this process.

Back in the early 1990s when pumping of Fresh Pond took place, Whittecar’s and Emry’s were worried that the continuous pumping that indeed lowered the groundwater level would jeopardize the ecology of wetlands in Nags Head Woods, take away too much water, and hence not be beneficial for the ecological well-being of the area.

Figure 3: Graphic depiction of the process of evaporation



Although these accounts confirm that pumping Fresh Pond can artificially lower the water table, we also have evidence that rainwater flooding occurred during the same time period. It follows that the bigger problem continues to be the density of built structures within a specific area. In comparison to the mid 1980s to early 1990s, when the research for the article took place, the west side neighborhoods of Nags Head nowadays feature a more continuous surface coverage.

David Ryan explains that as a potential indicator why the testing period for Vista Colony Pilot Project - didn’t demonstrate a significant lowering of the groundwater table in that area, from what was originally anticipated. . However, pumping water from a small pond adjacent to the Vista Colony neighborhood with off-site conveyance has assisted with removal of excess surface runoff accumulation during heavy rainfall events. It remains to be seen if similar systems can be

implemented elsewhere throughout Nags Head. Different subsections of the town have different environmental conditions and different levels of ground water tables.

Explanation 4: Swale maintenance

Other explanations that neighbors offer about the standing water are associated with the ditches or swales that are running along some streets in the neighborhood but not others. However, while almost everyone mentions the swales, there is a disagreement about their usefulness. These differences are captured by the following representative quotes.

In favor of ditches:

“I want the ditch dug out and want to build a bulkhead. I don’t want to lose my yard.”
“Why not concrete the ditches?”

Skepticism about the usefulness of ditches:

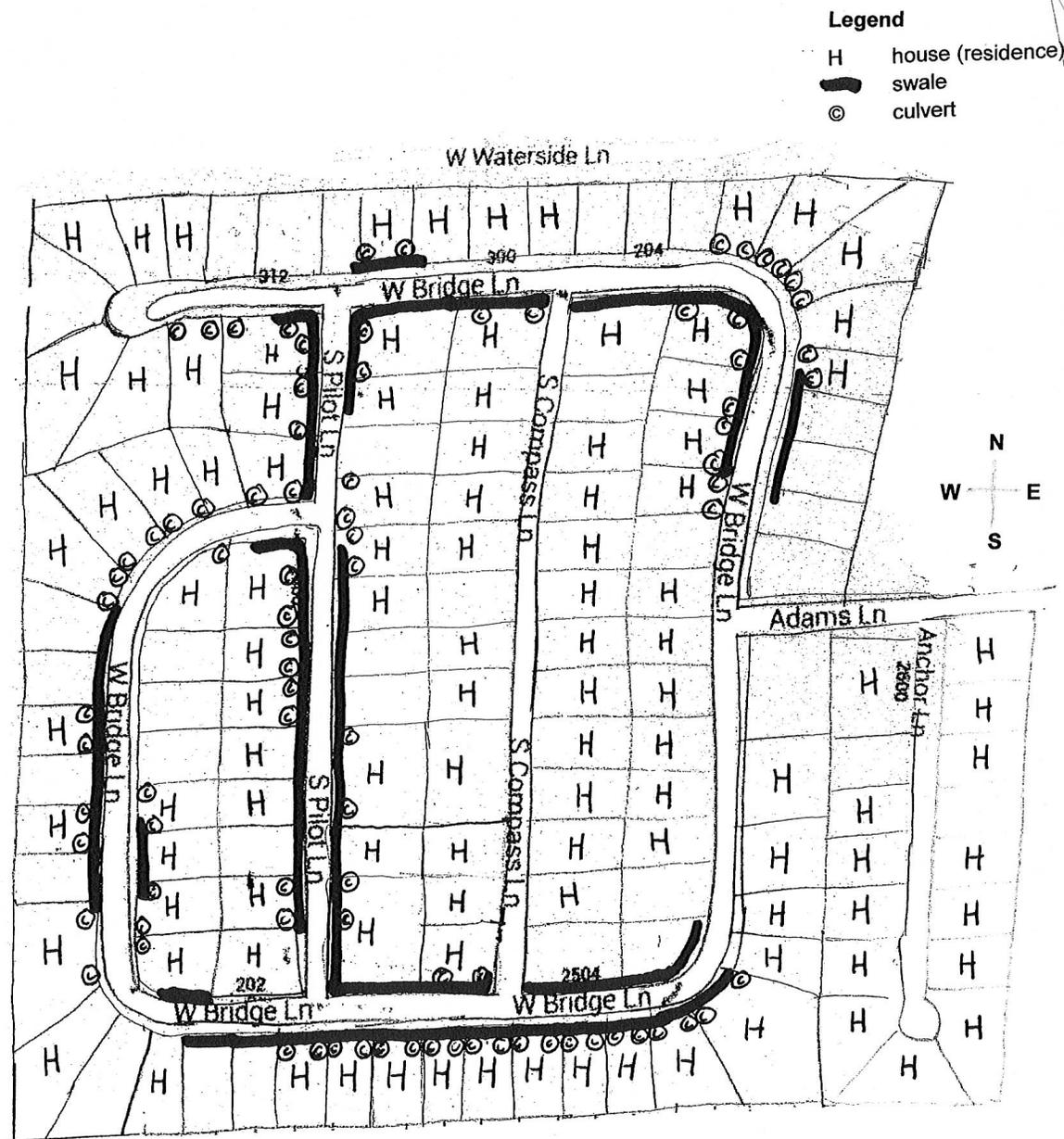
“It seemed like the digging of ditches made the water stand in there longer.”
“Our situation has nothing to do with the ditches.”
“We take great pride in our home. We like to make it look nicer. Ditches and swales don’t look pleasing.”

This discourse is also evident in the willingness to welcome swale/ditch creation on properties in Nags Head Acres that currently have no ditches in place. We review these opinions in the last section of this report.

David Ryan, the current town engineer, comments that the replacement of ditches with pipe conveyances impacts upstream drainage by effectively reducing open storage area to accommodate significant rainfall events. In some locations throughout Nags Head, the ditches also serve as groundwater lowering devices through intersecting the water table and creating an enhanced flow pathway. The Town of Nags Head is currently investigating alternate standards to address aesthetic concerns of neighbors. The Town has an annual ditch maintenance program. However, residents can also help these maintenance efforts by ensuring ditches and swales are clear of debris after a storm or rain event.

The following map outlines the existing swales and culverts in the neighborhood.

Map 2: Existing swales and culverts throughout the Nags Head Acres neighborhood



Explanation 5: Culvert maintenance

The maintenance of culverts is related to the maintenance of swales. Neighbors evaluate their role similarly and consider culverts either to be culprits for the lack of drainage or a useful remedy.

“Town said you’re supposed to have swales in the front yard. But some houses don’t even have culverts under their driveways.”

“A culvert doesn’t do any good if there is nowhere for water to go.”

“I covered up the culvert under my driveway because they don’t work and water stands under them.”

The following pictures show a comparison of a driveway with fully operating culverts, a driveway with closed culverts, and a driveway without culverts.



Explanation 6: Landscaping practices in general

The differences in opinions about best practices for the maintenances of spaces between the street pavement and any property also extend to choices for yard design, including lawn maintenances and plants. One group of neighbors favors lawns over trees. The other group is promoting to keep any trees and plants on the property as they are found prior to building on the lot. The first group includes mostly residents who have lived shorter periods of time in Dare County. The latter group is mostly comprised of residents who spent more than half of their lifetime in Dare County.

“We cut down a lot of trees. We couldn’t walk the backyard.”

“Grass is not meant to grow here.” and “Removing trees increases runoff.”

David Ryan comments that removing trees, compacting soils, and introducing impervious surfaces increases the runoff volume of storm water from a residential lot by as much as three times in comparison to an unaltered natural state. In addition, he suggests limiting landscaping improvements in the right of way, because it has the potential to alter drainage flow lines and discontinuing the conveyance patterns. These recommendations are also supported by the 2005 Report of the Outer Banks Hydrology Committee commissioned by then Senator Mark Basnight. Committee members, including CSI Director Nancy White, found that rain gardens and increase in certain vegetation is beneficial for the mitigation of storm water run-off.

Explanation 7: Different levels of elevation in the immediate neighborhood

All participants offered comments about the lack of grading in the neighborhood that made any existing differences in elevation immediately effective in directing the flow of water. Neighbors who own lower lying lots and driveways are considered to be disadvantaged in comparison to neighbors with slightly elevated yards and driveways. This is a particularly sensitive topic since any new construction is deemed advantageous to an established property structure due to the new requirements of the government for fill and elevation when building new houses.

“Driveways: what can you do? Pump it out and flood somebody else’s yard?”

“Building the yard up with soil, making it higher, is an issue.”

“When a lot is the lowest in a neighborhood section, it becomes the holding tank for all surrounding neighbors.”

David Ryan explains that the impervious surfaces created by driveways and built structures can alter natural drainage patterns especially in an environment constrained by limited topography. The addition of impervious coverage which fills in low lying areas can reduce the volume of natural above ground runoff storage areas. It also compacts soil limiting infiltration and removes vegetation that aids in evapotranspiration.

Furthermore, Mr. Ryan suggests that the fill provided on lots for new housing construction is not the single source behind standing water issues in the proximity of the development. Currently, fill up to 3ft is permissible, and anything in excess requires the prescriptive standard of other concessions, primarily for on-site storm water management. The Town of Nags Head is working on a text amendment for an ordinance that addresses fill due to evolving state and federal regulations which require elevating habitable floor space resulting in the use of fill to comply with these standards. While filling of lots could potentially lead to the alteration of natural drainage patterns, aggravating flooding in adjoining low-lying areas, implementing and maintaining drainage elements can mitigate the negative impacts associated with fill.

Explanation 8: Ocean outfall maintenance

The flow and grading issues in the neighborhood are reflected in explanations that cite the lack of connectivity to drainage systems outside the immediate neighborhood. Most participants mention that one of the ocean outfalls is not functioning correctly. In addition, neighbors describe that the connection between the local drainage pipe and the pipe leading to the ocean outfall is compromised and needs either a cleaning or a replacement.

“The town told us that the Red Drum outlet has not been cleaned out in a lot of years. Water has nowhere to go.”

“The pipe under the bypass is the problem. It doesn’t connect us.”

“The only solution is a pipe. But that would mean tearing up the bike path and the drive ways to get more piping in.”

“There are places on the beach, not sure how safe they are. Those ocean outfalls...”

David Ryan confirmed that the existing infrastructure for drainage conveyance in its current form is inefficient, limited by travel distance, tributary drainage area size, topography, tidal influence, and singular flow paths, all of which contribute to hydraulic overloading and congestion within the network. He explains that the NCDOT has responsibility for outfalls and is currently working on a plan for improvements to the ‘Red Drum’ ocean outfall. In addition, the town of Nags Head has sent a proposal to the NCDOT to call for the installation of a new pipe connection at W. Barnes St. which would create an additional flow path between Conch Street

ocean outfall drainage area and the 'Red Drum' ocean outfall drainage area. However, NCDOT must approve this approach before this proposal can proceed forward.

How is the standing water affecting septic tank management?

When preparing for this project we engaged in several informal conversations with residents of the Nags Head Acres subdivision. The question that frequently appeared in the discussion of long-term consequences of standing water was “what is the relationship between standing water and septic tank management?”

When we asked this question during our standardized conversations, we realized that residents who have spent more than half their lifetime in Dare County usually bring up this point before we get to it on our list of questions. They were mostly in agreement that standing water can cause septic back up and issues with proper drain field operation in general. Other participants either were unsure about the relationship between standing water and septic tanks or think that there is no relationship between the topics. Very few neighbors wonder if the septic systems have caused the water table to rise.

Here are a few exemplary voices of neighbors that review the relationship between septic systems and storm water flooding.

“Using septic tanks equals pollution.”

“If the flooding continues, we will have a septic tank problem.”

“There were many new drain fields put in after Sandy.”

“I don't think the septic tanks have elevated the water table. But the water table has affected the septic tanks. Drain fields are too close together.”

The distribution of opinions between residents who think that standing water may have an influence on septic tanks, and residents who don't think there is an effect, compelled us to ask a few more general questions about septic tank management and operation. We realized that answers were a function of length of experience with septic tank management. Neighbors with fewer years of residency in Dare County who have never encountered any problems with their septic tank usually don't have much reflections or suggestions to offer. They consider it a non-issue and expect their septic tank to last without major problems or need for repair for more than 30 years.

Figure 4: Graphic display of word frequencies evaluating the relationship between septic tank maintenances and standing water

See No Relationship Between Standing Water and Septic

Standing Water Causes Septic Backups

Standing Water Harms Drain Fields

Septic Systems Raise Water Table

The town of Nags Head receives praise for their Septic Health Initiative Program. Almost half of all participants mentioned the program as their reliable source of information and assistance. The appreciation regarding the change in programs and assistance is captured by the following statements of a long term resident:

“We used to not want it (septic tank) pumped because back in the 1970s and 80s the health department would make you replace the drain field after pumping three times. But now the town gives credit for tank pumping on your water bill.”

Almost everyone agrees on the indicator for malfunctioning of a septic tank: *“You know something is wrong with your septic tank , when your toilets won’t flush or you hear a gurgling sound.”*

Conversations about day-to-day septic tank management were not based on a check list of suitable activities. We didn’t ask participants to confirm particular practices. Rather, we collected what suggestions people brought up themselves in reference to our question about daily practices. Most residents don’t communicate details. We heard only a few singular statements, such as ‘don’t wash laundry during a storm’, ‘wash dishes by hand’, ‘don’t use antibacterial soap’, and ‘don’t put coffee grinds down the drain.’ The majority of neighbors have a ‘same as we always do anyway’ take on this issue. However, we specifically asked how guests from out of town are instructed. Few residents consider it necessary to instruct visitors from places outside of Dare County in toilet etiquette while at the beach. We frequently heard *“I would hope my guests have common sense.”*

There is uneasiness among neighbors when they asked to discuss septic systems. It is preferably treated as “out of sight, out of mind” which confirms the general cultural attitude towards this type of human waste. When we encouraged participants to come up with suggestions for improvement of septic tank management, more than half of all neighbors brought up the topic of central sewage systems as operated in the Kill Devil Hills’ Ocean Acres area and the Village of Nags Head subdivision. The topic also came up at the end of our conversations when we asked participants to identify town and county wide improvement projects for which they would be willing to pay additional taxes. Taken together, these conversations revealed three groups of opinions among neighbors. A small group of neighbors is adamantly against any change to the current system of individual septic tanks. They find the search for alternatives unnecessary. Most

of them either grew up in Dare County or have lived there for more than half of their lifetime. Another third of neighbors is in favor of a switch to a small centralized sewage system for the immediate neighborhood and would be willing to pay additional fees for such an installment.

“I would rather have a few small centralized sewage systems. The grass is definitely greener over the septic field. More fertilizer so to speak. You wonder what is going on... everyone is wondering.”

“Central sewage is much better. The town is populated, so why would that be so hard? But residents have to vote and agree on fees and taxes they are willing to incur.”

The group of neighbors that shares viewpoints that fall between these oppositions considers the general concept of a move away from individual septic tanks attractive. They ponder the potential dangers of either septic tank failure and subsequent pollution of the local waterways or a disastrous failure of a larger system due to a hurricane. But they are also against any additional cost that a centralized system would command. They expect the water bill per household to increase manifold.

“Don’t want to pay a monthly sewage fee over replacing septic system once every 25 years or so.”

More importantly, however, the most frequently mentioned argument against small, centralized sewage treatment plants throughout the beach towns of Dare County is that the limitations of septic tanks are a protection against overdevelopment and increased density of population settlement. Many residents find it difficult to trust that local ordinances against building heights and occupancy rates will continue to be enforceable. However, the absence of sewage systems that could handle larger numbers of residents at a specific location, is considered the best safety mechanism to insure against the influx of more people to the area, and the best protection of the current way of life in the beach towns.

“The drawback of a few small centralized sewage plants throughout the town is that it makes denser development possible.”

What to do about the standing water? Suggestions from inside and outside the neighborhood

Not all residents of the Nags Head Acres subdivision are equally affected by standing water. The neighborhood has one very visible “wet spot” with continuous standing water and an additional eight to ten driveways and backyards throughout the neighborhood that are periodically flooded for more than three days. It is easy to see how any neighborhood-wide storm management effort might not find much support among neighbors who are not affected. In fact, our original plan to speak with a member of each household in the subdivision was impossible to carry out, because

many residents who we approached for a conversation, declined the invitation with statements such as

“I can’t imagine to go through what they go through, but it doesn’t bother me. It’s not my property.”

“I don’t go there.”

“I go the other way when there is standing water in the road. That’s all there is to it.”

However, implementations of remedial measures for standing water throughout the neighborhood by the town of Nags Head might bring visual changes to unaffected neighborhood lots. Furthermore, changes in the amount of rainfall or severe storm events might bring flooding to areas in the neighborhood that have been previously unaffected.

Therefore, in this final section of our report we want to present opinions about possible remedies. First, we describe what some of your fellow neighbors have already practiced. Next, we review responses to suggestions we brought to our conversations. This allows you to gauge the willingness to support specific measures among your neighbors. We also assess the interest in using the empty lot at 2620 W. Bridge Lane as a remedy. The report concludes with a reflection about the acceptance of financial challenges that any solution for the standing water issues might pose to fellow residents.

We often heard the following sentiment: *“Neighbors should contain the water on their own property.”*

What have affected neighbors done to remedy the problem on their own? Half of all affected neighbors have done nothing on their own to make the standing water disappear. They either have no possible path of action or would like to see the Town of Nags Head put in pipes or maintain ditches. The other group of affected neighbors has installed pumps on their own property to alleviate storm water issues or cleaned out culverts and ditches.

Suggestions by residents of Nags Head Acres

Both affected and unaffected neighbors make suggestions for remedies of future storm water management. The following graphic captures the level of importance of each suggestions quite poignantly. The call for ditch maintenance is strongest, followed by a call for installation of a new piping system for the neighborhood, a pumping system similar to the remedies offered to the Vista Colony neighborhood and better ocean outfall maintenance.

Figure 5: Graphic display of neighbors' suggestion for reducing standing water issues in NHA

Add Pumping System
Ditch Maintenance
Add Culverts and Pipes
Ocean Outfall Maintenance
Create Retention Pond

Interestingly, residents who have not lived more than half their lifetime in Dare are more likely to make suggestions than people who have not grown up in Dare. The latter say they are landscaping their culverts on their own and that is all that is necessary. Regardless, ditch maintenance seems to be considered the main option to ensure better storm water management in the immediate future.

Suggestions for the empty lot on 2620 W. Bridge Lane

A few neighbors also bring up the creation of a neighborhood retention pond to solve the standing water problem prior to our question about suggestions for the empty lot on 2620 W. Bridge Lane that is surrounded by a ditch continuously filled with standing water. However, only one third of participants suggest that the empty lot be used as a retention area. They would be willing to support such an endeavor financially. The majority of neighbors is skeptical about the empty lot and its capacity to assist in storm water retention.

“Can’t imagine the neighborhood coming together to buy the lot.”

“Town shouldn’t use tax dollars to buy it.”

Town commissioners have discussed to buy the empty lot at their July 3rd (2013) meeting when the town manager Cliff Ogburn requested a closed sessions to discuss the acquisition of real properties located at 204 W. Lost Colony Drive and 2620 S. Bridge Lane.

Responses to alternative property management practices

We also asked about the willingness of participants to implement amendments to their properties within the Nags Head Acres subdivision in reference to the following seven suggestions:

- (1) recreate ditches in locations without ditches
- (2) deepen ditches on properties that already have ditches
- (3) install of culverts under driveways
- (4) convert all or parts of the driveways to non-concrete driveways with permeable paving
- (5) plant more trees anywhere on the property
- (6) designate an area of the yard to planting a rain garden
- (7) collect water in rain barrels and use that water for plants, car wash, etc.

Results show that there is no unified view about maintaining curb appeal in light of managing storm water runoff. In reference to swales or ditches, 20% of participants have ditches in front of their house, the remaining neighbors are divided between supporters and non-supporters. Half of the residents without ditches in front of their properties would welcome them and the other half states they rather do without them. It is important to note that neighbors who have encountered flooding incidents on their yards or in their driveways are not automatically supporting the installment of swales or ditches. However, with just a few exceptions, neighbors willing to have swales put in front of their property, also support the installment of culverts under their driveways. More than 60% of neighbors support the deepening of ditches. The other 40% consider it unnecessary since it is not proven that it would help the drainage situation.

The modification of driveways to create a negative incline at the point where street and driveway meet as seen in the Vista Colony subdivision is not a welcome proposition for more than 60% of neighbors. The suggestion to exchange concrete driveways with permeable materials gets rejected by two thirds of neighbors. Residents who spent more than half their lifetime in Dare County are more likely to support the replacement of concrete driveways with non-concrete solutions than residents who spent a smaller portion of their lifetime near the beach. This pattern continues, albeit with weaker tendencies, in respect to support of additional tree planting and implementation of rain gardens. Tree planting in general is welcomed by 55% of residents. A phrase we often heard was

“Planting additional trees would be fine. But I hate pines.”

Others explain that they have enough trees already. These proportions are similar for the suggestion to dedicate a portion of the yard to a rain garden. More than half of the participants are in favor (55%) but others have either tried it and haven't see any improvement or are not inclined to make such drastic changes to their yards. Almost all participants support the use of rain barrels. However, many neighbors mention that they would make this conditional on the town providing them with rain barrels rather than having to purchase them themselves.

Financing change

Financing neighborhood-wide adjustments to storm water management came up multiple times during our conversations with residents. To assess both willingness to allocate additional funds for storm water management and the priority of of storm water management solutions in reference to other Dare County wide needs for taxpayer monies, we asked participants to sort cards that listed different projects that might get individual approval or rejection. We tasked out conversation partners to consider a situation in which they have a choice towards which outcomes they want to channel their household funds. We called it a game with the assumption that households have additional funds to allocate. We included localized neighborhood projects such as a drainage lot and drainage pipes, small, centralized sewage systems, more recreational facilities, an additional neighborhood park, and continued beach nourishment on separate cards. To stimulate the conversation and selection process we also listed countywide issues such as replacing the Bonner Bridge, and more resources for schools. We also provided residents with the option to evaluate cards that listed the option to put additional household funds towards increased insurance coverage for their family members rather than public interest projects.

The majority of neighbors opt to allocate more money for schools alongside financing a replacement of the Bonner Bridge and an overall solution for highway 12 to create a reliable

access to Hatteras Island. This was followed by requests to finance a replacement of drainpipes in the neighborhood and possibly financing a drainage lot.

“If the town can spend money on beach nourishment, it can fix drainage problems.”
“We really need an engineering solution for the storm water runoff problems. The town needs the money and the will. We already pay \$ 80 per year for beach nourishment and \$ 4 per months for storm water management. But I haven’t seen much done with it yet.”

Next in line are continued beach nourishment efforts grouped with recreational facilities and neighborhood parks. Financing an alternative to the current septic system received uneven support. As stated above, some favored it and others sorted it aside, which explains its “fourth place” as a result of the sorting task. Private interests such as increased insurance coverage were also put in low priority positions.

The sorting task had the intended effect that participants used the opportunity to reflect on the dimension of costs in relation to their own budget and the budget of the town of Nags Head. The following two representative statements capture the majority of sentiments regarding neighborhood-wide remedies. The overall consent is that the current funds in the coffers of the Town of Nags Head should be sufficient to eliminate long term standing water in the neighborhood.

“Depends on the cost. I don’t want any more fees.”
“But if we have to pay for a remediation: we won’t do it.”

However, as stated at the beginning of this section, many residents also brought up the topic of cost independently of our probing during conversations. Our last graphic is a depiction of the major concerns of neighbors after combing through all interview scripts, coding for worries and concerns. Cost concerns clearly stand out as the most salient feature among the statements about length of standing water. We also see neighbors asking for better communication with town officials. We tackle this notion in the next paragraph.

Figure 6: Graphic display of Nags Head Acre residents’ major concerns

Communication with Local Government
Cost Concerns
Standing Water Causes Health Concerns
Aesthetics and Curb Appeal

Communication with Town of Nags Head administrators

A third of the residents we talked to feel rather powerless in terms of finding a solution to their property related problems. They don’t consider their ideas and wishes to carry much weight in the decision-making processes at town council meetings.

“Local residents don’t have much influence. There is always somebody ready to move to the beach. If somebody leaves, somebody else is willing to move in.”

Political processes in communities take time and effort. We wish not to evaluate or comment on the level of power or influence that residents have. However, we would like to suggest that knowing about the distribution of opinions, might help neighbors to join forces and streamline requests for town council members during one of the upcoming commissioner meetings.

Limited information flow is another grievance that more than half of the residents explicitly stated. They would like to receive more information from town officials prior to the implementation of remedies or any new installations in the neighborhood. The perception of inadequate dissemination of information is not easy to overcome. Based on our experience with reaching residents, we find that the distributing information is indeed challenging for both senders and receivers in an age of decentralized media consumption. The public information officer of town of Nags Head, Roberta Thuman, operates a Facebook account and a twitter account. It maintains a town webpage that makes the minutes of town commissioner meetings available to residents and the local newspapers post reports on new developments about results of administrative decision-making. However, checking town news cannot be made a mandatory part of residents’ daily routine. There is a Nags Head’s email update list that Roberta Thuman manages as well. It is a broadcast only list. Postings to this list will not be processed. If interested, you can contact Roberta Thuman: Roberta.Thuman@nagsheadnc.gov. However, understandably not all residents wish to make their personal phone number and/or email address part of the public record.

We would like to suggest that in addition to frequent postings of information by the Town of Nags Head on all media outlets, each Nags Head Acres household decides if they either want to be part of the email update list or make it a habit to check the town webpage for announcements on a daily basis.

Concluding Remarks: Where to go from here?

A detailed look at opinions and perceptions of a third of Nags Head Acres residents has shown that there seem to be at least two different views about most subjects. Half of the residents welcome more plants and trees; the other half would rather not change any parts of their lawns. Some residents consider the lack of swales the major culprit for standing water, others don’t see any functionality of swales. A few residents would welcome a small, centralized sewage system, while others find it too expensive or too dangerous as an invitation for more density or simply unnecessary. However, these groupings are not forming two polarizing camps. There are residents who would to plant more trees, but rather not dig a swale. There are neighbors who want swales and a centralized sewage system. However, all conversation partners agreed that a better flow of storm water needs to be achieved and the best option might be the installation of additional drainage pipes. This generally conciliatory attitude is also evident in the fact that almost everyone we spoke to realizes the limitations of living on a barrier island as these two statements exemplify:

“We are on a shifting piece of land and can’t make it stand still.”

“I realize we are at the beach. But there should be a way to make it drain.”

Increased density of residential and commercial lot coverage throughout the barrier island is what constitutes the current circumstances for storm water and septic tank control. These conditions cannot be reversed, they can only be managed. If the ground water area is saturated and coverage has reached a maximum, the pathways for water flow are not open. Residents should avoid additional coverage that might hamper the conveyance of water. The efforts should also focus on remedies that either can utilize storm water or facilitate its flow under the soil.

A combination of remedies is most likely the best approach for a long-term solution. As the Report of the Outer Banks Hydrology Committee from 2005 already suggested, such a combined approach should include the planting of more vegetation on private property. The selection of such plants or trees should be appropriate for the region and need to be planted in safe distance from septic tanks to avoid roots disabling the functionality of the septic system. Wells to take care of plants have also proven to be a useful remedy to keep the existing ground water level. Properties that currently have no swales surrounding them should be evaluated for feasibility of swales. If considered useful, permits can be issued for their creation. The Town of Nags Head has commissioned a group of citizens to rewrite storm water policy and that is expected to aid in such procedures. To aid in the maintenance of ditches residents have suggested that garbage collectors employed by the Town of Nags Head could take over the responsibility of maintaining the ditches/swales. In addition, perforated pipes could be used as culverts wherever practical. Although not popular, non-concrete/permeable paving might also be considered for any new construction areas since these practices have a proven effect.

We sincerely hope that the information and potential remedial measures discussed in this report will foster a dialogue among you, the residents of Nags Head Acres, and between you and the town engineer, town planners, town manager and town commissioners. If you have any additional information or suggestions to contribute to this report that warrants a written update, please feel free to contact us via the information provided below. We will include it and send out a revised copy to all involved parties. Thank you for your participation in this effort.