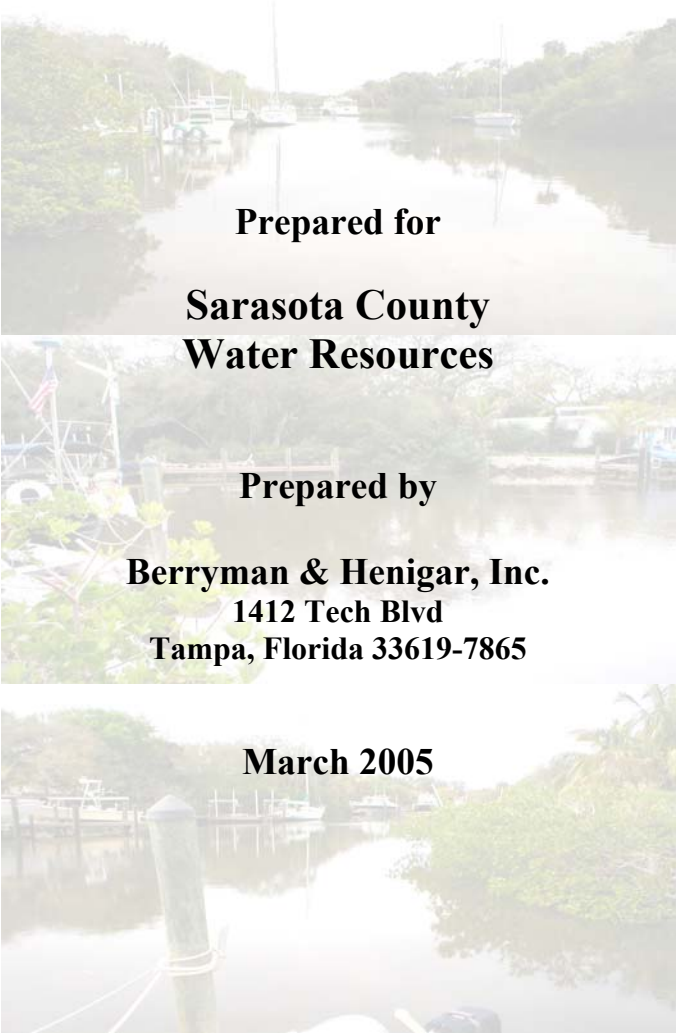
HIDDEN HARBOR
SEDIMENT ABATEMENT STUDY



Prepared for

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1.0 INTRODUCTION

Sarasota County's Navigable Waterways Program (NWP) routinely conducts feasibility studies for residential canal dredging throughout the unincorporated coastal regions of the County. To compliment some of the feasibility projects, Sarasota County has engaged Berryman & Henigar, Inc. (BHI) to perform a series of sediment abatement analyses to determine if opportunities exist for reducing future land-based sediment accumulation in the canals. Sedimentation is a significant concern to the citizens residing along the canals. Residents with property along canals in the County are typically assessed for the costs of canal dredging.

This report is the fifth of a series of sediment abatement studies being conducted by BHI for the County. The areas being examined include:

- Baywood Canal
- America Drive Canal
- Phillippi Cove
- South Creek
- Hidden Harbor
- Cedar Cove
- Phillippi/Pinecraft

The area being considered for this study is Hidden Harbor, located on the northeast side of Siesta Key, east of Midnight Pass Road, about 1.5 miles south of the Siesta Drive bridge Hidden Harbor is essentially a widened residential canal that serves as a mooring basin and opens to the Intercoastal Waterway in Roberts Bay, north of Phillippi Creek. See Figure 1 for the project location map.

2.0 BACKGROUND

Hidden Harbor is a dredged basin that opens to Roberts Bay. The basin shelters recreational boats and the dredged spoil provided fill material for house lots. The water body is approximately 1,330 feet long and 65 to 110 feet wide.

One of the concerns voiced by the citizens along several residential canals is the possibility of future sedimentation from stormwater runoff causing a loss of canal depth after the expense of the dredging operation. To address those concerns, the County has engaged BHI to analyze the stormwater systems entering the canals and estimate the effects these systems may have on future sediment accumulation.

3.0 SITE CONDITIONS

Canal sedimentation can be the result of many factors, including stormwater discharges, upland erosion, illegal discharges, algae build up from high nutrient levels in the canals, wind blown currents, or tidal influences. Most canals are influenced by a combination of these factors. A careful investigation is required to determine the causes of sedimentation prior to recommending courses of action to reduce sedimentation in canal systems.

Figure 1	Project Location Map	Berryman & Henigar

Field investigations of the canal were made by BHI staff on December 21, 2004 and February 28, 2005. The small community is densely vegetated with natural vegetation, with site clearing only for roads, driveways, and houses with no grass lawns. Landscaping is informal, invoking a jungle-like atmosphere. Roads consist mainly of pavers, which allow some of the stormwater to infiltrate and thus reduce runoff volume and sediment load.

The drainage basin for the canal is generally bordered by Hidden Harbor Way and Roberts Bay Lane on the west, Roberts Bay on the east, Tropical Circle on the north, and North View Drive on the south. The overall drainage basin consists of 36 acres of mostly single-family residential lots. See Figure 2, which shows subbasins within the study area.

Soils in the area consist predominantly of Canaveral and Pompano fine sands, nearly level, poorly-drained dark gray fine sand, with smaller areas consisting of Kesson and Wulfert mucks. Also, it is assumed that natural soils bordering the canal are covered with dredged material.

None of the streets bordering the canal have gutters. The rear one-half of all lots bordering the canal drain directly to the canal via sheet flow. The fronts of the lots either pond and/or infiltrate on the yards and sides of the road. As previously stated most of the roads consist mainly of pavers, and most driveways consist of either gravel or pavers. In addition most yards are maintained in a natural state and they perform as bioretention or buffer strips. As can be seen in the site photographs, most streets are clean and well maintained.

There are no stormwater pipes that discharge to the canal. Each basin is identified and discussed below.

3.1 Basin 1

This drainage basin area consists of 11.3 acres of single family residential property and drains properties along Hidden Harbor Road and Jungle Plum Road. This is the largest drainage basin discharging to the canal but the roads consist of pavers (Figure 3) and along with the yards are performing as stormwater treatment systems by reducing the amount of runoff and sediment being discharged to the canal. The rear of the lots has either rip-rap and or mangroves stabilizing the canal side slopes (Figure 4). A cleared lot was found off Hidden Harbor Road that had the proper sediment and erosion controls in place (Figure 5). There was no sediment build up observed along the shoreline at this basin.

3.2 Basin 2

This drainage basin area consists of 7.2 acres of single family residential, low density residential and open space property. This basin drains properties mostly along Jungle Plum Road and a few properties along Hidden Harbor Way and Hidden Harbor Road. The roads also consist of pavers (Figure 6) and along with the yards are performing as stormwater treatment systems by reducing the amount of runoff. Furthermore most houses have gravel (Figure 7) and/or pavers (Figure 8) driveways with very few concrete driveways. A cleared lot was found off Hidden Harbor Way that had failing sediment and erosion controls in place (Figure 9). There was no sediment build up observed along the shoreline at this basin.

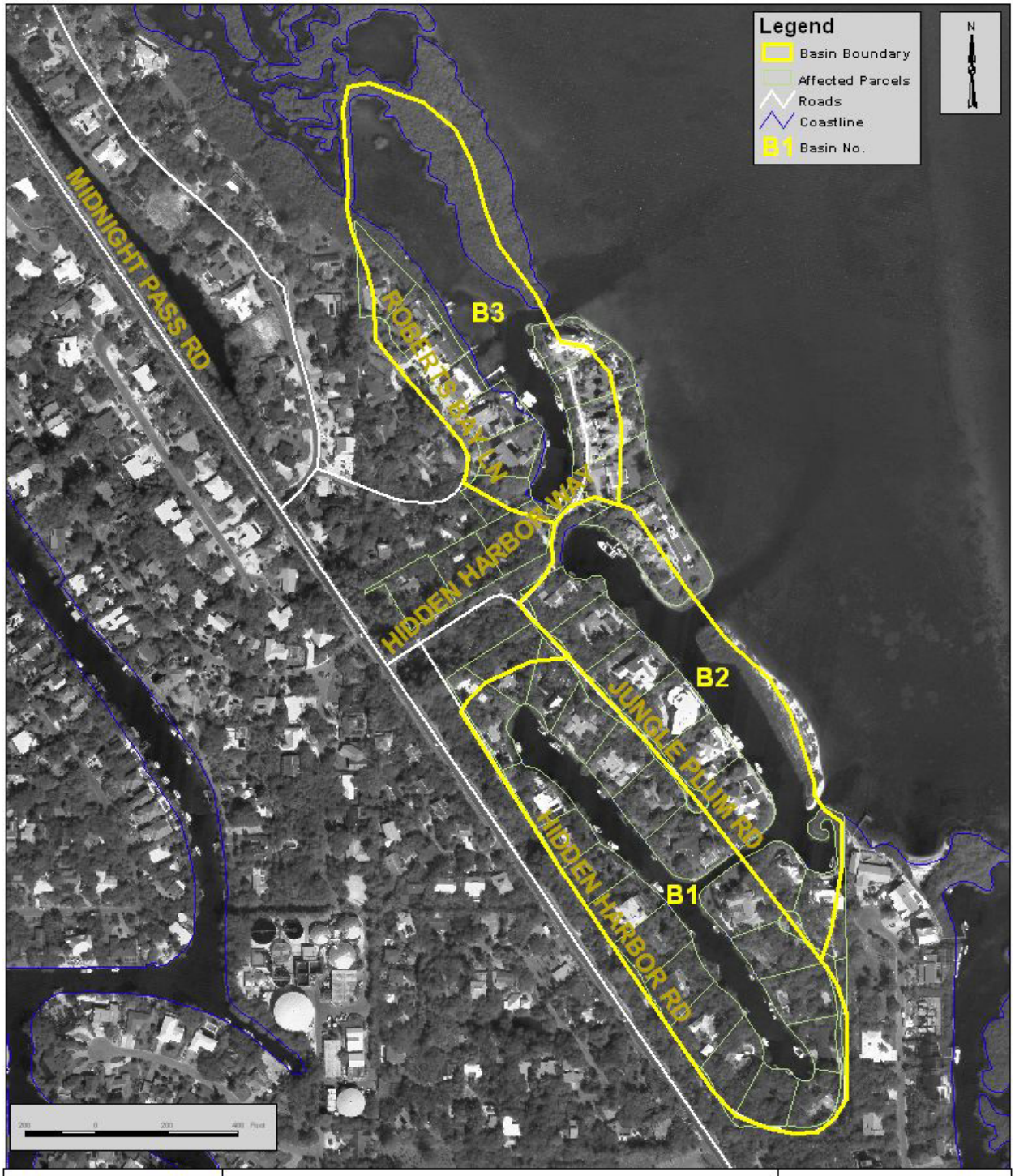

Figure 2	Existing Features Map	Berryman & Henigar

Figure 3.
Pavers road on Hidden Harbor Rd. in Basin B1.

Figure 4.
Rear of residential lot off Jungle Plum Rd. in Basin B1.

Figure 5.
Construction site with proper sediment and erosion control in Basin B1.

Figure 6.
Cul-de-sac at the end of Jungle Plum Rd. in Basin B2.

Figure 7.
Gravel driveway on a house in Basin B2.

Figure 9.
Pavers driveway on a house in Basin B2.

Figure 9.
Failed silt fence in Basin B2

Figure 10.
Ponding on side of paved road along Roberts Bay Ln. in Basin B3.

Figure 11.
Ponding on front yard in a house in Roberts Bay Ln. in Basin B3.

3.3 Basin 3

This drainage basin area consists of 7.6 acres of single family residential and open space property, and it drains properties along Roberts Bay Lane and Hidden Harbor Way. Half of the roads also consist of pavers but the roads along Roberts Bay Lane are paved (Figure 10). Ponding along the sides of the road and in the yards was observed. As a result the paved roads are producing a higher volume of runoff than the pavers roads but the yards are performing as stormwater treatment systems by retaining most of the runoff onsite (Figure 11).

4.0 POLLUTANT LOADING ASSESSMENT

A pollutant loading analysis was performed to quantify potential land-based sediment and other pollutant loadings entering the canal. The analysis used a spreadsheet-based model, with loading estimates based on land uses from the Southwest Florida Water Management District (SWFWMD) FLUCCS land use GIS coverage, drainage basin boundaries obtained from Sarasota County, stormwater treatment efficiency rates for Best Management Practices (BMPs) (ASCE, 2001), and annual pollutant loading unit rates (ERD, 1994). Loading rates used are summarized in Table 1. BMP treatment efficiencies are shown in Table 2. Land uses were field verified. This type of planning-level analysis does not take into account short-term erosion from sources such as construction sites or leaking pipe joints.

It should be noted that the fact that most of the roads consist mainly of pavers, most driveways consist of either gravel or pavers, and most yards are maintained in a natural state, these features perform as bioretention or buffer strips by retaining a volume of runoff and by preventing much

debris and sediment from entering the canal. These features provide a high level of treatment to runoff, so pollutant reduction factors for onsite retention were used in the analysis where appropriate.

Pollutant loadings were estimated by multiplying the total acreage in each drainage basin by a composite annual loading rate that was developed by weighting the land use specific loading rates by the relative proportion of basin area in that land use. Where appropriate, the gross loadings were adjusted to account for BMP reduction factors to estimate the net pollutant loadings by parameter.

The existing conditions pollutant loadings are presented in Table 3. Loadings were calculated for total suspended solids (TSS), total phosphorus (TP), and total nitrogen (TN). While TSS can account for sediment build up in a canal, nutrients from TP and TN can lead to algae blooms and vegetation growth, with subsequent muck accumulation in water bodies. The assessment estimates current TSS loading at 518 kg/year, TP loading at 10 kg/year, and TN loading at 104 kg/year.

Using a typical unit weight for sandy silt of 90 lb/cubic foot (Dunn et. al., 1980), the 1,143 lb annual sediment load could contain a volume of approximately 13 cubic feet (0.5 cubic yards), or about 0.00036 inches annually over the area of the canal bottom. However, under field conditions, the sediment would tend to accumulate near the outfalls, although tidal flows would disperse the sediment throughout the canal and into Roberts Bay.

Table 1.
Summary of unit pollutant loading rates for central and south Florida (ERD, 1994).

LAND USE CATEGORY	UNIT LOADING RATE (kg/ac-yr)						
	TOTAL N	ORTHO-P	TOTAL P	BOD	TSS	TOTAL Zn	TOTAL Pb
Low Density Residential	2.88	0.169	0.320	7.63	31.9	0.06	0.052
Single-Family	4.68	0.335	0.594	14.3	56.1	0.122	0.083
Multi Family	8.51	0.924	1.72	38.4	256	0.188	0.299
Low-Intensity Commercial	5.18	0.157	0.650	36.1	343	0.511	0.635
High Intensity Commercial	13.0	1.52	1.96	79.3	435	0.782	0.985
Industrial	7.30	0.519	1.24	39.5	383	0.543	0.872
Highway	6.69	0.361	1.32	21.9	182	0.508	0.727
Agricultural							
a. Pasture	4.54	0.732	0.876	7.99	126	---	---
b. Citrus	2.91	0.123	0.197	3.60	21.9	---	---
c. Row Crops	2.84	0.421	0.595	---	---	---	---
d. General Agriculture	3.62	0.380	0.551	5.80	74.0	---	---
Recreational/Open Space	1.07	0.003	0.046	0.956	7.60	0.005	0.021
Mining	2.21	0.131	0.281	18.0	176	0.229	0.378
Wetland	1.81	0.204	0.222	4.96	11.2	0.009	0.039
Open Water	3.23	0.130	0.273	4.02	8.05	0.073	0.065

Table 2.
BMP selection guide (ASCE, 2001).

BMP	Design Factor				Type of Pollutant					
	Land Area Needed	Distance Above Groundwater	Soil Type Needed	Cost	Mainten-ance	Total Nitrogen % Removal	Total Phosphorus% Removal	Suspended Solids % Removal	Heavy Metals % Removal	Floating Trash Removal
Ponds										
Dry Retention Online	High	Low	A or B	High	Medium	60-98	60-98	60-98	60-98	High
Dry Offline Retention or Detention	High	Low	A or B	High	Medium	60	85	90	65-85	High
Wet Detention	High	High	Any	High	Low	26	65	75	25-70	High
Wet Detention With Filtration	High	Low	Any	High	High	25	65	85	60-85	High
Dry Detention	High	Low	A or B	High	Medium	15	25	70	35-70	High
Alum System		NA	NA	High	Medium	50	90	90	80-90	0
Constructed Wetlands	High	0 ft.	C or D	High	High	****	****	High	High	High
Sand Filters										
Austin Sand Filter	Medium	2 ft.			High	31-47	50-65	70-87	20-84	N/A
D.C. Underground Sand Filter	Medium				High					N/A
Delaware Sand Filter	Medium	2 ft.			High	47	41	57	45.2	N/A
Alexandria Stone Reservoir Trench	High				High	47.2	63-72	79-84	***	N/A
Texas Vertical Sand Filter	Medium	7 feet	N/A		High					N/A
Peat Sand Filter	Medium				High					N/A
Washington Compost Filter System	200 S.F/cfs	4 feet	N/A		High	N/A	41	95	75.8	N/A
Other										
Baffle Boxes	Low	NA	NA	Medium	Medium	0	30-40	20-90	Unknown	Low
Vegetated Swales	Medium	Low	A,B, C	Medium	Low	0-25	29-45	60-83	35	Low
Buffer Strips	Low	1 ft-2 ft	A,B,C	Medium	Low	20-60	20-60	20-80	20-80	Low
Infiltration Trenches	Low	2-4 ft	A or B	Medium	High	45-70	50-75	75-99	75-99	High
Inlet Devices	None	NA	NA	Low	High	**	**	Low-Medium	Low	High

** Traps particulate phosphorus and nitrogen in the form of leaves and grass - not effective for dissolved nutrients

*** No Data Available

**** Varies widely

Table 3. Hidden Harbor Canal Pollutant Estimates
Existing Conditions

Basin No.	Area (ac)	Land Use	Type of Treatment System	% TSS Reduction	% TP Reduction	% TN Reduction	TSS Loading Rate (kg/ac-yr)	TP Loading Rate (kg/ac-yr)	TN Loading Rate (kg/ac-yr)	TSS Loading (kg/yr)	TP Loading (kg/yr)	TN Loading (kg/yr)
1	11.28	Single Family Residential	Onsite Retention	60	29	5	56.1	0.59	4.68	253.1	4.8	50.2
2	0.75	Low Density Residential					31.9	0.32	2.88	23.8	0.2	2.1
2	5.91	Single Family Residential					56.1	0.59	4.68	331.6	3.5	27.7
2	0.57	Open Space					7.6	0.05	1.07	4.4	0.0	0.6
2	7.23	Total Basin Land Use	Onsite Retention	60	29	5				143.9	2.7	28.9
3	5.06	Single Family Residential					56.1	0.59	4.68	283.9	3.0	23.7
3	2.58	Open Space					7.6	0.05	1.07	19.6	0.1	2.8
3	7.65	Total Basin Land Use	Onsite Retention	60	29	5				121.4	2.2	25.1
	TOTALS									**518.4**	**9.7**	**104.2**

5.0 DISCUSSION AND RECOMMENDATIONS

Existing conditions land-based pollutant loadings to the canal were calculated for total suspended solids (TSS), total phosphorus (TP), and total nitrogen (TN). The estimate loadings are 518 kg/year for TSS, 10 kg/year for TP, and a TN loading of 104 kg/year.

The 1,143 lb annual sediment load could contain a volume of approximately 13 cubic feet, or about 0.00036 inches annually over the area of the canal bottom. As stated above however, under field conditions, the sediment would tend to accumulate near the outfalls, although tidal flows would disperse the sediment throughout the canal and into Roberts Bay. It should be noted that nutrient control is an important element of water management. Excess enrichment can result in algae blooms, excess aquatic vegetation growth, and subsequent accumulation of detritus turning to muck. Thick layers of muck were observed in other canals in the general area, mainly in dead-end canals with mangrove or overhanging trees and brush.

This section describes recommendations on how to reduce runoff-borne sediment from entering the canal. Nutrients can become adsorbed onto sediment particles, so trapping sediment also can reduce nutrient loading to the estuarine system.

Although not widely observed, some silt accumulation was noted on the bottom of the canal and can be indicative of a combination of sediment from soil erosion and muck from high nutrient levels in the canal. Potential nutrient sources include algae from the bay, fertilizers, leaves, organic yard debris, and pet wastes from local runoff. Reduction of nutrients in urban settings can be more effectively accomplished with source controls. Educating the homeowners in the area to reduce fertilizer use, prevent yard waste from entering the canals would benefit the nutrient levels in the canals. Also, small back yard swales to hold runoff instead of letting it run directly into the canal can be effective.

The dead-end portions of the canal have limited or no circulation due to tidal exchange, therefore, they could have conditions such as low dissolved oxygen levels and silt accumulation. High nutrient levels can lead to algae blooms, which lead to muck accumulations.

There were some areas with leaves in the street and near the shore which could end up in the canal. These nutrient sources affect the muck build up in the canal. It is therefore recommended that the County continue to provide public education regarding methods of source control and single lot design that could reduce sediment and nutrient loadings to the canal.

Specific recommendations for each subbasin outfall are also included in this section. Each outfall to the canal is discussed below.

5.1 Basin 1

This basin drains properties along Hidden Harbor Road and Jungle Plum Road. Although this is the largest drainage basin with the largest pollutants loadings, no new BMPs are recommended for this basin because the pavers roads and onsite retention are working properly as stormwater systems.

5.2 Basin 2

This basin drains properties mostly along Jungle Plum Road and a few properties along Hidden Harbor Way and Hidden Harbor Road. No new BMPs are recommended for this basin because the pavers roads and onsite retention are working properly as stormwater systems. However, due to failing sediment and erosion controls at a vacant Hidden Harbor Way lot, BHI recommends new silt fences to be installed to avoid further erosion.

5.3 Basin 3

This basin drains properties along Roberts Bay Lane and Hidden Harbor Way. No new BMPs are recommended for this basin, despite the fact that the paved roads along Roberts Bay Lane are producing a higher volume of runoff than the pavers roads, because the yards are performing as stormwater treatment systems by retaining most of the runoff.

6.0 CONCLUSIONS

The Hidden Harbor Canal has some, but not severe, sedimentation problems typical of many residential canals along the coastline. Accumulations of sediment occur from natural erosion and anthropogenic activities such as construction and land clearing. In addition, muck accumulates in canal bottoms from algae blooms caused by elevated nutrient levels in the canal waters. Stormwater runoff brings nutrients and other pollutants to the canals where poor circulation allows the pollutants to settle to the bottom. With the canal dredging project being investigated by the County, it is natural that the affected property owners would inquire as to possible methods to reduce future sedimentation and dredging expenses.

An analysis of the land uses and drainage basins of the canal was undertaken to determine possible causes of sediment build up in the canals. To further examine potential pollution sources to the canals, a pollutant loading analysis of the stormwater runoff from the watershed was undertaken. TSS, TN, and TP loadings were estimated using a spreadsheet calculation accounting for the land areas, land uses, pollutant loadings, and existing stormwater treatment systems. This analysis suggests that the highest pollutant loadings originate in basin B1, the largest basin, despite the pavers roads and the yards that are performing as onsite retention by treating and reducing the amount of runoff. All of the residential basins were considered to have treatment systems in place.

Based on the field investigations and analysis in this report, no structural BMPs are recommended, but due to failing sediment and erosion controls at a vacant Hidden Harbor Way lot, it is being recommended that new silt fences will be installed to avoid further erosion.

One of the most important aspects of pollutant reduction is source control. A strong public education effort will inform residents that changing their day to day activities can be one of the best methods of pollution control. By reducing fertilizer application amounts and frequencies, controlling disposal of yard debris, and cleaning pet refuse, the homeowners can take a large part in reducing nutrient loading to the canals and thereby reducing muck accumulations in the canals.

7.0 REFERENCES

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