



May 9, 2017

PEA Project No: 2016-344

Mr. Joseph Maniaci
Mondrian Properties
50215 Schoenherr Rd.
Shelby Twp., MI 48315

via email: jmaniaci@mondrianproperties.com

**RE: Bank Erosion Investigation
Raintree Village – Regional Retention Pond
City of Troy, Oakland County, Michigan**

Dear Mr. Maniaci,

PEA, Inc. has researched the history and conducted a site visit to the retention pond located at Raintree Village Subdivision No.1 in the City of Troy. The purpose of our investigation was to review the pond design and observe potential eroding banks along the pond and provide recommendations for restoring them if needed.

We initially contacted the City of Troy Engineering Department and Oakland County Water Resources Commissioner (WRC) to inquire if there were historical issues or concerns of erosion associated with the pond. We were informed by WRC that prior to development of this parcel, the Shanahan Drain (a County Drain) traversed linearly across this property. In the early-seventies, the developers of Raintree No.1 petitioned WRC (then Oakland County Drain Commission (OCDC)) for an in-line retention basin. OCDC approved the in-line basin with the condition that all pond maintenance would strictly be the responsibility of the homeowner's association. Additionally, we learned the pond was accepted, by the City of Troy, as a regional detention basin with the capacity to service Raintree Village Subdivision No.1, 2, 3 and over 200-acres north and west of Raintree. The total drainage district is 525.29-acres. Over the years, the City has approved the regional pond for detention of several other subdivisions within this district, including but not limited to; Judy Estate Sub and Wattles Ridge Condo. Both agencies concluded that, to their knowledge, there has been no communication with Raintree Village Homeowner's Association (RVHA) regarding the pond until recently due to the sale of the school property.

According to the RVHA, over the last 40-years there has been little-to-no maintenance to the pond, with exception to keeping the outlet structure clear of debris.

During our site visit, we observed the water level was approximately 0.75-feet below the normal water depth. We photographed the pond banks and observed minor long-term erosion at the toe-of-slope. There are areas where the pond banks have sloughed into the water and other areas where the pond bank has eroded due to long term wave action or seasonal water fluctuations. There was also



some evidence of rainwater runoff causing some surface erosion, and ducks/geese trampling the banks and eating the plants that secure the soil. As related to erosion, the only area of concern is at the inlet from the Shanahan Drain. The banks have eroded behind the wing walls. The slopes adjacent to the wing wall are nearly vertical and approximately 4-ft high above the water surface.

We also reviewed historical aerial photographs from 1999 to 2017 and compared them to the original design plans. It appears that the pond is essentially the same shape, but the banks have receded about 6-ft over the last 40-years.



According to the As-Built Pond Drawing, prepared by MCS Engineers, dated May 9, 1974, the original pond was designed to have 4-feet of permanent water. Above the permanent water, or normal water elevation, the pond will store up to 5-feet of detention.

In order to confirm the original pond design, we re-calculated the required detention volume based on the OCDC Detention Method using a post-development run-off coefficient for the 525.29-acres which yielded approximately 968,000-cf of detention storage required. We also confirmed that the retention volume available was approximately 977,000-cf. These calculations are consistent with the “Storm Water Detention Study for Raintree Subdivision No. 1 and No. 2”, prepared MSC in February of 1973 and re-confirmed by correspondence from David Lindquist to the City in February 1980.

In addition to confirming the storage volume, we re-ran the outflow calculations from the restricted outlet as design by MCS in 1973. Our calculations confirmed that once the total drainage district of 529.29-acres is developed, the storm water flow would not exceed the present agricultural discharge for a 10-year storm design.

Based on our research and calculations, the detention pond is functioning as designed and has the capacity to service the total drainage district of 529.29-acres. The erosion issue does not impact the function of the detention system – it is an aesthetic condition. Although no survey or probing was conducted during our investigation, it is apparent that the pond slopes below the water surface are flatter than the designed 1:6 slopes. It is also apparent, that over the years, sediment has collected in the bottom of the pond. While the collection of sediment decreases the permanent volume in the pond, it has no detrimental effect on the detention volume.

As previously mentioned, the erosion of the pond banks has occurred over 40-years with no preservation. The majority of the side-slopes are unvegetated and drop 1 to 2-feet off the edge and left untreated will continue to erode. At a minimum, the banks near the Shanahan Drain outlet and the headwall should be restored.

As far as corrective action, there are several methods that can be used to repair the pond bank erosion. We have provided 3 possible solutions:

- Stabilize the existing condition
- Flatten the bank slopes to 1:6 or flatter
- Reclaim lost material from the pond and restore the pond to original condition.

All three options incorporate soil stabilization together with vegetation cover. Based on the current toe-of-slope location, re-sloping the bank could impact existing trees and may extend the top of bank into the residential lots. Soil reinforcement or soil retaining may include soft armor like erosion control blankets, or hard armor such as; stone rip-rap, geoweb or Geotech Tube to re-establish the toe-of slope and stabilize newly placed material.

Costs vary depending on the option or combination of repair methods. We have not prepared a detailed remediation plan. However, we assumed that draining, excavating and restoring the pond to original condition would not be cost effective. We have provided two preliminary cost opinions based on treating the existing conditions and preventing future erosion. Costs for these improvements range from \$50,000 to over \$130,000. At a minimum, RVHA should re-establish the slopes near the headwall and backfill behind the wingwalls to prevent the possible failure of the drain outlet.

Please let us know if you have any questions or need any additional information.

Sincerely,

PEA, Inc.



John B. Thompson, PE
Senior Project Manager

Attachment: Cost Opinion #1
Cost Opinion #2



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PRELIMINARY COST OPINION

PROJECT DESCRIPTION RAINTREE PARK BASIN OPTION #1 **JOB NO.** 2016-344
PREPARED BY TMK **REVIEWED BY** JBT **DATE** 05/02/17

SCOPE

Small brush and vegetation shall be scarified and removed from the area of work. Regrade the slope from the edge of water to 10' (horizontal) in order to remove the near vertical existing edge and flatten the slope. Once regraded, seed using "slope stabilizing seed mix" and cover with staked straw blanket and live stakes. Steep slopes (+/- 30' either side of the headwall) should be cutback and banks rip-rapped - the area behind the rip-rap and headwall should be backfilled and seeded with straw blanket.

SUMMARY

SITE IMPROVEMENTS

Demolition	\$6,000.00
Earthwork & Erosion Control	\$38,200.00
Subtotal Site Improvements	\$44,200.00
15% Contingency	
Total Site Improvements	\$50,000.00

NOTE: The engineer has no control over the cost of labor, materials, equipment or services furnished by others, over the contractor's method of determining prices, or over competitive bidding or market conditions. His opinions of probable project costs and construction costs provided for herein are to be made on the basis of his experience and qualifications and represent his best judgment as an experienced and qualified engineer familiar with the construction industry. But, the engineer cannot and does not guarantee that proposals bids or actual project or construction costs will not vary from opinions of probable costs prepared by him.

PROFESSIONAL ENGINEERING ASSOCIATES, INC.
 2430 ROCHESTER COURT, SUITE 100
 TROY, MICHIGAN 48083-1872
 (248) 689-9090

COST OPINION

PROJECT NAME RAIN TREE PARK BASIN OPTION #1 JOB NO. 2016-344

DEMOLITION

PLAN QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	ITEM PRICE
0.40	AC.	CLEAR AND GRUB	\$15,000.00	\$6,000.00
TOTAL DEMOLITION				\$6,000.00

EARTHWORK & EROSION CONTROL

PLAN QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	ITEM PRICE
2,340	S.Y.	FINE GRADE AND COMPACT	\$3.50	\$8,190.00
1	L.S.	RESTORE SLOPE AND RIP-RAP HEADWALL	\$10,000.00	\$10,000.00
630	L.F.	TREE PROTECTION FENCING	\$5.00	\$3,150.00
2,340	S.Y.	SEED - SLOPE STABILIZING MIX	\$2.00	\$4,680.00
1	L.S.	LIVE STAKES	\$5,000.00	\$5,000.00
2,340	S.Y.	STAKED STRAW BLANKET	\$2.00	\$4,680.00
1	L.S.	RESTORE DISTURBED AREAS	\$2,500.00	\$2,500.00
TOTAL GRADING & EROSION CONTROL				\$38,200.00

SUBTOTAL				\$44,200.00
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PRELIMINARY COST OPINION

PROJECT DESCRIPTION RAINTREE PARK BASIN OPTION #2 **JOB NO.** 2016-344
PREPARED BY TMK **REVIEWED BY** JBT **DATE** 05/02/17

SCOPE

Small brush and vegetation shall be scarified and removed from the area of work. Regrade the slope from the edge of water to 10' (horizontal). Once slope is regraded and compacted, install 3-foot wide band of rip-rap (6"-8" stone) over erosion control blanket (woven). Install seeded, staked straw blanket from rip-rap to top of disturbed area. Steep slopes (+/- 30' either side of the headwall) should be cutback and banks rip-rapped - the area behind the rip-rap and headwall should be backfilled and seeded with straw blanket.

SUMMARY

SITE IMPROVEMENTS

Demolition	\$6,000.00
Earthwork & Erosion Control	\$114,710.00
Subtotal Site Improvements	\$120,710.00
15% Contingency	
Total Site Improvements	\$138,000.00

NOTE: The engineer has no control over the cost of labor, materials, equipment or services furnished by others, over the contractor's method of determining prices, or over competitive bidding or market conditions. His opinions of probable project costs and construction costs provided for herein are to be made on the basis of his experience and qualifications and represent his best judgment as an experienced and qualified engineer familiar with the construction industry. But, the engineer cannot and does not guarantee that proposals bids or actual project or construction costs will not vary from opinions of probable costs prepared by him.

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COST OPINION

PROJECT NAME RAINTREE PARK BASIN OPTION #2 JOB NO. 2016-344

DEMOLITION

PLAN QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	ITEM PRICE
0.40	AC.	CLEAR AND GRUB	\$15,000.00	\$6,000.00
TOTAL DEMOLITION				\$6,000.00

EARTHWORK & EROSION CONTROL

PLAN QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	ITEM PRICE
2,340	S.Y.	FINE GRADE AND COMPACT	\$3.50	\$8,190.00
780	S.Y.	RIPRAP, (6"-8" STONE)	\$105.00	\$81,900.00
780	S.Y.	EROSION CONTROL BLANKETS	\$3.50	\$2,730.00
630	L.F.	TREE PROTECTION FENCING	\$5.00	\$3,150.00
1	L.S.	RESTORE SLOPE AND RIP-RAP HEADWALL	\$10,000.00	\$10,000.00
1,560	S.Y.	SEED - SLOPE STABILIZING MIX	\$2.00	\$3,120.00
1	L.S.	LIVE STAKES	\$2,500.00	\$2,500.00
1,560	S.Y.	STAKED STRAW BLANKET	\$2.00	\$3,120.00
TOTAL GRADING & EROSION CONTROL				\$114,710.00

SUBTOTAL				\$120,710.00
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