SECTION 7 - IMPLEMENTATION STRATEGY

7.1. Introduction and Purpose

Improving the water quality of Easter Lake is a complex and challenging effort that will require collaboration of the project sponsors over the next 10 years. The purpose of this section is to outline specific dates, milestones, and accomplishments in a sequence that will most effectively guide key actions to reach water quality goals. The 2005 TMDL was used to calculate pollutant reduction goals, which includes 40% reduction for phosphorus, and 23% reduction in sedimentation loadings to Easter Lake.

Although several management practices addressing pollutant delivery to Easter Lake have been implemented in the past, the ISU DF study indicates that significant sediment and phosphorus loading reductions using additional watershed management practices are required. Potential engineering modifications to improve water quality downstream could include targeted stream stabilization/protection and dredging existing detention ponds in the southeast subbasin to restore function. Additionally, public involvement and participation in watershed management practices to reduce phosphorus and sediment loads from the watershed will be required to achieve the 40% reduction in total phosphorus loads required to meet the reduction levels listed in the 2005 TMDL, which is used as the primary source in identifying and calculating pollutant reduction targets. Engineering solutions alone cannot reach the required total phosphorus loading reduction target without best management practices implemented by the community (ISU 2011).

Although the goal of this Basin Plan is to remove Easter Lake from the impaired waters list, the structural and programmatic BMPs recommended have multiple benefits. These include, but are not limited to: reduction of a wide range of other pollutants, reduced stormwater runoff volume, reduced landscape maintenance, increased stream stability, reduced infrastructure cost downstream, recharging groundwater levels, aesthetics, and increasing the overall health of the Easter Lake watershed.

This implementation strategy was written using input from the project stakeholders, ISU's DF study, NRCS studies, and public, the summary of conclusions drawn during the planning process, and a review of other available information. The implementation plan was based upon a balance of available resources and the process necessary to achieve the plan's ultimate goal of removing Easter Lake from the Clean Water Act Section 303(d) list of impaired waters and achieving IDNR's lake restoration goals. This implementation section includes combinations of several strategies that have been discussed in previous sections.

The Easter Lake watershed is divided into seven subbasins following existing stormwater drainage infrastructure and natural topography to allow for a more manageable evaluation and resource gathering. Subbasins considered a higher risk for delivery of sediment and other pollutants are identified specifically for certain water quality practices.

Input from the TAT and SC was used to establish the priority areas for concentrating implementation of structural BMPs over the next 10 years. An effort to implement programmatic BMPs have been recommended watershed wide over the life of the plan. To increase public acceptance of stormwater management practices, several demonstration structural BMPs have been recommended to be constructed, such as the Ewing Park bioswales. Driven by a strong desire from Des Moines residents and Easter Lake visitors, the Easter Lake implementation strategy is aggressive but achievable.

7.2. Implementation Overview

A three phase approach has been established that allows for resources to be concentrated on reducing the pollutant load and runoff in the watershed prior to the start of major renovation actions in and around Easter Lake. In addition, a strong information and education effort will be utilized to increase the effectiveness of programs and provide information on other activities and their water quality benefits.

The implementation strategy includes three phases covering the 10 year lifetime of the plan.

Phase One, 2012-2014, focus on reducing the pollutant load throughout the entire watershed through implementation of programs that include financial incentives and cost-share opportunities. Phase one also begins the process of stream restoration of Yeader Creek to reduce sedimentation. Phase One includes design and planning for lake restoration but does not include major in-lake construction work. The timing of projects for Phase One is found in Table 7-6: Phase One (2012-2014).

Phase Two, 2015-2018, continues watershed work, stream restoration, and includes the lake renovation projects. At the end of Phase Two, Easter Lake is planned to be refilled and restocked with fish. The timing of projects for Phase Two is found in Table 7-7: Phase Two (2015-2018).

Phase Three, 2019-2021, includes continuation of watershed projects and information and education. Each phase is subject to change due to unforeseen opportunities, such as new funding sources, geomorphic changes to the stream of lake, shifting priorities, and timeliness of other major projects, such as sewer line construction or continued development in the south-east basin. The timing of projects for Phase Three is found in Table 7-8: Phase Three (2019-2021).

Table 7-1: Implementation Strategy Summary

Phase	Years	Focus	Key actions
One	2012-2014	• Reducing runoff and pollutant sources in the watershed • Information and education • Stream restoration • Lake improvement design	• Financial incentives for water quality BMPs • Installation of bio-infiltration BMPs in watershed • Grade control, stream bank stabilization in Yeader Creek and 'South Arm' • Design and plans for lake improvements
Two	2015-2018	• Continuing watershed work • Continuing stream restoration • Lake improvement construction	• In-lake improvements and dredging • Aquatic habitat improvements • Watershed BMPs • Information and Education
Three	2019-2021	• Continuing watershed work • Easter Lake rehabilitation completion	• Financial incentives for water quality BMPs • Installation of bio-infiltration BMPs in watershed

At the time project planning takes place, it is important to coordinate with other construction efforts in the project area. Known projects include the Easter Park trail expansion, sewer line expansions, Easter Lake Drive replacement, Wastewater Reclamation Authority (WRA) projects. These projects may create opportunities to expedite the timelines, such as dredging the Southeast Subbasin detention structures that may be drained to install a new sewer system. Also, additional projects in the watershed could also delay lake and watershed projects. Coordination between all projects sponsors will be vital to ensure a cost effective strategy is determined when projects occur in the same area, before it is too late to make changes. A summary of the phases, dates, and the focus and key actions of each phase is provided below in Table 7-2: Project Cost and Reduction Summary.

7.2.1. Estimated Cost and Pollutant Removal Efficiencies

It should be understood that the information provided in Table 7-2 are estimates to be used for planning purposes. A series of assumptions were made to allow calculation of expected pollutant removal efficiencies of each recommended practice. It should also be understood that the expected load reduction percentages provided in Table 7-2 for the recommended structural projects are not the direct additions of the load reduction percentages which are presented later on each individual structural project cut sheet. The removal percentages presented in Table 7-2 are the product of multiple iterations of removal load reduction calculations of each structural project, programmatic BMP reduction estimates and estimates based upon proposed implementation schedules compared to total watershed pollutant loads.

The information/education programs are also expected to account for additional reductions in both phosphorus and sediment. Due to the variability of the impression information and education can have on property owners a general reduction range of 1-4% and 5-10% for sediment and phosphorus respectively was estimated. The greater the effort put forth by project stakeholders, the greater likelihood that reductions occur through education and information.

This same unknown range of effectiveness is present when forecasting reduction levels for programmatic BMP implementation. Therefore, a general reduction range of 2-5% and 5-10% for sediment and phosphorus respectively was estimated.

The consultant used construction cost estimates from similar projects within the region, program cost estimates for similar program implementations around the region, and best technical judgment to develop the estimated costs provided in Table 7-2.

Table 7-2: Project Cost and Reduction Summary

	Implementation Cost	Sediment Reduction (tons)	Phosphorus Reduction (lbs)
Phase One (2012-2014)			
Programmatic BMPs	$972,000	140-350 (2-5%)	210-430 (5-10%)
Stream Restoration	$785,500	480 (7%)	50 (1%)
Lake Improvements (Design)	$462,500	NA	NA
Coordinator / I&E	$300,000	70-280 (1-4%)	210-430 (5-10%)
Monitoring	$35,000	NA	NA
Sub-totals	**$2,555,000**	**690-1,110 (10-16%)**	**470-910 (11-21%)**
Phase Two (2015-2018)			
Programmatic BMPs	$2,004,000	140-350 (2-5%)	210-430 (5-10%)
Stream Restoration	$868,500	880 (12%)	80 (2%)
Lake Improvements	$2,687,500-7,982,500	2,310 (33%)	900 (21%)
Coordinator / I&E	$300,000	70-280 (1-4%)	210-430 (5-10%)
Monitoring	$125,000	NA	NA
Sub-totals	**$5,985,500-11,280,500**	**3,400-3,820 (48-54%)**	**1,400-1,840 (33-43%)**
Phase Three (2019-2021)			
Programmatic BMPs	$1,158,000	140-350 (2-5%)	210-430 (5-10%)
Coordinator / I&E	$250,000	70-280 (1-4%)	210-430 (5-10%)
Monitoring	$35,000	NA	NA
Sub-totals	**$1,443,000**	**210-630 (3-9%)**	**420-860 (10-20%)**
Estimated Grand Total	**$9,983,500-15,278,500**	**4,300-5,560 (61-79%)**	**2,290-3,610 (54-87%)**
TMDL Target Reduction		**1,600 (23%)**	**1,710 (40%)**

In order to understand how projects will work together in reducing both sediment and phosphorus loadings across the entire watershed, milestones have been established for each targeted pollutant by phase. Milestones were established by assuming full implementation of all BMPs as they have been recommended in this plan. Due to a variety of available sources for sediment and phosphorus loading estimates, as estimated in Section 5, the consultant has chosen to use the 2005 TMDL current loading rates to calculate milestones as seen below in Tables 7-3 and 7-4. These tables are intended to forecast the anticipated reductions at the end of each phase. In-lake sedimentation reduction milestones have been displayed to represent annual loss of volume while phosphorus reduction milestones represent the forecasted reduction load to the lake from improvements taking place throughout the watershed. Based on current sediment loading estimates, Easter Lake is losing 4.6 acre feet of volume per year. If all proposed BMPs were implemented, the annual lake volume loss would be reduced to 2.1 acre feet per year. Lake mapping (bathymetry) recommendations are listed in Section 8- Monitoring and will be used to determine if the volume reductions are being achieved. Monitoring will also need to be completed to measure if actual phosphorus reduction milestones have been achieved.

Due to the uncertainty in knowing if all projects will be implemented, and the unknown level of implementation of programmatic BMPs by watershed property owners, it is important to note that actual results will vary. In order to measure actual results in-stream and in-lake monitoring will be necessary. Monitoring strategies have been identified in Section 8 – Monitoring.

Table 7-3: Easter Lake Sediment Milestones

Scenario	Lake Volume (acre feet)	Cumulative Volume Loss (acre feet)	Siltation Rate (tons per year)	Meets TMDL Target
Current (2012)	1338	592	7,000	No
End of Phase 1 (2014)	1329	601	6,300	No
End of Phase 2 (2018)[1]	1593	337	3,280	Yes
End of Phase 3 (2021)	1587	343	3,180	Yes
TMDL Target[2]		< 643	<5,400	NA

[1] Phase includes dredging approximately 280 acre feet / [2] 2005 TMDL target for Easter Lake

[3] Future bathymetry data will determine actual siltation rates

Table 7-4: Easter Lake TSI Milestones

Scenario	TSI Secchi	TSI Chlorophyll a	TSI Total Phosphorus	Meets TMDL Target of <65	Meets Delisting Target of 63 or less for two consecutive listing cycles
2002-2006 Conditions[1]	67	64	64	No	No
2004-2008 Conditions[2]	67	59	70	Yes	No
2006-2010 Conditions[3]	65	63	64	No	No
2011-2012 Conditions	66	60	63	No	No
End of Phase 1 (2014)	67	57	65	No	No
End of Phase 2 (2018)	62	60	69	No	No
End of Phase 3 (2021)	59	55	61	Yes	Yes

[1] Corresponds with data collection period used to develop the 2008 305(b) Report

[2] Corresponds with data collection period used to develop the 2010 305(b) Report

[3] Corresponds with data collection period used to develop the 2012 305(b) Report

During the establishment of the Plan several detailed structural projects were identified with a focus on three primary areas, Easter Lake (EL), Yeader Creek (YC), and the watershed (WS). Each project is summarized in Table 7-5: Proposed Structural Projects and further detailed later in this section. As projects sponsors identify other opportunities for watershed projects, similar to the Ewing Park bioswales, this project list will likely increase. Table 7-3 is a composite of projects identified during the planning process and is not a complete list of specific projects. Project sponsors are encouraged to implement a variety of BMPs listed previously in Section 6 – Management Practices as opportunities present themselves.

Table 7-5: Proposed Structural Projects

Project Number	Project Name	Description	Subbasin Location
EL-1	Easter Lake In-lake Improvements	Aquatic habitat improvements	Easter Lake
EL-2	West-arm Sediment Forebay	Construction of a new sediment forebay across the west arm	Easter Lake
EL-3	South-arm Sediment Forebay	Sediment removal and rehabilitation of the south-arm sediment forebay (Easter Lake Drive Bridge)	Easter Lake
WS-4	Detention Structure Dredging	Dredging of existing detention structures on the Southeast Sub-watershed	Southeast
EL-5	Easter Lake Outlet Structure Retrofit	Retrofit to the Easter Lake outlet structure to limit upstream travel of non-game fish species	Easter Lake
WS-6	Detention Structure Construction	Construction of remaining 3 proposed detention structures in the Southeast Annex Area Comprehensive Stormwater Study - 1994	Southeast
EL-7	Easter Lake Dredging and Shoreline Rehabilitation	Dredging of 225,000 cubic yards of sediment Easter Lake and rehabilitation of 3,600-feet of shorelines	Easter Lake
YC-8	South Branch Yeader Creek	Installation of 4 grade control structures and one rock chute southeast of Wal-Mart	South Branch
YC-9	Lower Main Branch SE15th to 17th Street	Creek stabilization through installation of 2 grade control structures, 1 rock chute, and toe rock areas	South Branch
YC-10	Main Branch E. McKinley Ave & SE 9th Street	Installation of 1 grade control structure, toe rock area, and storm sewer outfall improvement	SE 14th Street
YC-11	Main Branch at SE 2nd to 5th Street	Creek stabilization through installation of 4 grade control structures	SE 14th Street
YC-12	Main Branch near SE 1st Court & SE Porter Avenue	Creek stabilization and erosion control using 1 rock chute and toe rock areas	Sayers Park
YC-13	Main Branch from SW 8th to S Union Street	Creek stabilization and erosion control using 1 rock chute and toe rock areas	Sayers Park
YC-14	Spring Street	Creek stabilization and erosion control using 2 grade control structures and toe rock areas	Southside Library
WS-15	Ewing Park Bioswales	Installation of 3 separate bioswales located north and south of McKinley Ave and at the Ewing Dog Park. Use of rain gardens, native grass swales, training dikes, and bioswales.	South Branch
EL-16	Easter Lake Rearing Pond	Sealing or reconstruction	Easter Lake

7.3. Phase One – Years 1-3

Phase One projects and programs are aimed at reducing external load pollutants through cost-share and financial incentives (e.g. no-phosphorus fertilizers) in addition to stream restoration projects. Decreasing the transport of eroded soil is critical to restoring Easter Lake and the watershed to a healthy, functioning system and to slow a return to current degraded lake conditions, post-restoration (ISU 2011). The focus of these projects will be a reduction in external loading, focusing on sedimentation and phosphorus. Specific project implementation activities will be led by an Easter Lake Watershed Coordinator with a focus on urban conservation and information and education. The coordinator position will continue through Phases One and Two, and be re-evaluated at the end of Phase Two to determine if the position should remain through Phase Three.

Several of the Phase One projects will be implemented with Rainscaping Iowa practices with assistance of the Polk SWCD's urban conservation program. A specific target will be on the Easter Lake watershed property owners. The timing of projects is subject to change based upon other planned activities including sewer line and trail expansions. A key factor in the final decision to begin projects will hinge on the ability of project stakeholders to collaborate during planning and design.

Table 7-6: Phase One (2012-2014)

Date	Project #	Project name	Primary action	Notes
Fall 2012	NA	BMPs	319 Funding	Application Due October 2012
	NA	Demonstration BMPs	Identify locations and funding	
Winter 2012	WS-15	Ewing Park Bioswales	Design	City
Spring 2013	NA	Demonstration BMPs	Continue through 2013	Polk SWCD
	WS-15	Ewing Park Bioswales	Select Contractor	City
	YC-8	Spring Street Project	Design	City
	YC-14	South Branch Grade Control	Design	
	NA	Establish water quality programs	Coordinate agency roles/responsibilities	Utilize Rainscaping Iowa practices
	NA	Easter Lake Coordinator Position	Coordinate a lead agency	PSCD lead
Summer 2013	WS-15	Ewing Park Bioswales	Construction	City
	NA	Easter Lake Coordinator Position	Hire Coordinator	PSCD
	YC-8	Spring Street Project	Select Contractor	City
	YC-14	South Branch Grade Control	Select Contractor	
Fall 2013	YC-8	Spring Street Project	Construction	City
	YC-14	South Branch Grade Control	Construction	
Winter 2013	EL-1, 2, 3, 5, 7, 16	In-lake Improvements	Design	Assuming PCCB Easter Lake trail receives funding

Date	Project #	Project name	Primary action	Notes
Fall 2014	EL-1, 2, 3, 5, 7, 16	In-lake Improvements	Complete design	
	YC-9 through YC-13	Yeader Creek Improvements	Begin Design	Priority of projects TBD
Winter 2014	EL-1, 2, 3, 5, 7, 16	In-lake Improvements	Prepare & Coordinate	
	EL-1, 2, 3, 5, 7, 16	In-lake Improvements	Select contractor	

7.4. Phase Two – Years 4-7

Phase Two focuses on starting in-lake improvements such as sediment removal, aquatic habitat improvement, and construction of a west-arm sediment forebay. The coordinator position will remain through Phase Two.

Table 7-7: Phase Two (2015-2018)

Date	Project #	Project name	Primary action	Notes
Spring 2015	EL-1, 2, 3, 5, 7, 16	In-lake Improvements	Lower lake level 8-feet	Lake work contingent upon trail work across west arm
Summer 2015	YC-9 through 13	Yeader Creek projects	Complete design	
	EL-1, 2, 3, 5, 7, 16	In-lake Improvements	Begin construction	
Fall 2015	YC-9-13	Yeader Creek projects	Start construction	Project priority TBD
	WS-4	Detention Structure Dredging	Design	
	EL-5	Outfall Structure Modification	Complete installation	Screening alternative
	EL-3,1, 7	In-lake Improvements	Continue construction	
	YC 9-13	Yeader Creek projects	Continue construction	Project priority pending
	Non- structural BMPs	Rainscaping Iowa practices	Continues	
	EL-2	West Arm Sediment Forebay	Construction complete	
	EL-3	South-arm Sediment Forebay	Construction complete	
	NA	Fish Renovation	Watershed-wide fish renovation	
Winter 2015	EL-1	In-lake improvements	Construction complete	
Spring 2016	EL-7	Dredging and Shoreline Rehabilitation	Construction complete	Assess fishery stocking
	WS-6	New Detention Structures	Update Design	Pending development in the area
Summer/Fall 2016	NA	Easter Lake	Fill to conservation pool	
Spring 2017	NA	Easter Lake	Fill fish stocking	

Date	Project #	Project name	Primary action	Notes
	YC 9-13	Yeader Creek projects	Complete construction	
Summer 2017	WS-6	New Detention Structures	Complete design and bid	
Fall 2017	WS-6	New Detention Structures	Construction	
Spring 2018	Programmatic BMPs	Rainscaping Iowa practices	Continues	Emphasis on EL Watershed through Phase II
Summer/Fall 2018	NA	Watershed projects	Continue	

7.5. Phase Three – Years 7-10

Phase Three focuses on continued watershed work, information and education, and finalizing any stream restoration and in-lake work. The coordinator position may continue through Phase Three.

Table 7-8: Phase Three (2019-2021)

Date	Project #	Project name	Primary action	Notes
2019	NA	Watershed Projects	Continues	
	NA	Programmatic BMPs	Continues	
2020	NA	Watershed Projects	Continues	
	NA	Programmatic BMPs	Continues	
2021	NA	Watershed Projects	Continues	
	NA	Programmatic BMPs	Continues	

7.6. Recommendations

In addition to the stream restoration, in-lake, and watershed structural projects; other key recommendations were developed with the overall goal of reducing the sediment and phosphorus loading to within the TMDL limits for Easter Lake. To achieve this goal, a variety of control strategies to reduce pollutant loading are recommended to be implemented. These control strategies can include a combination of structural and non-structural stormwater BMPs encompassing both source controls and water treatment technologies. Other considerations such as policy changes or incorporation into planning principles that would encourage activities to limit future pollutant loading to water bodies are also included. Although all strategies listed in Section 6 – Management Practices are available, the following strategies are priorities to be implemented throughout all subbasins.

- **Rainscaping Iowa** – Utilize the Rainscaping Iowa practices and the Polk SWCD Urban Conservationist and Easter Lake project coordinator to target the Easter Lake watershed for water quality improvements. Obtain grant funding to provide residents and property owners with cost share opportunities. Focus on soil quality restoration, bioswales, native landscaping, native turf, permeable pavement systems, rain gardens, and rainwater harvesting.
- **Pet Waste** – Provide pet waste disposal cans and utilize education and outreach to emphasis the importance of picking up pet waste in order to improve water quality.

- **Long Grass Maintenance Areas** – Incorporate additional long grass maintenance areas adjacent to the lake to reduce erosion and discourage waterfowl use. Also consider long grass areas in City and County park drainage ways and ditches.
- **No-phosphorus Fertilizer Program** – Establish a program to educate residents, property owners, and lawn care providers on the water quality benefits of no-phosphorus fertilizer. Emphasize the value of this practice and the relationship to improve Easter Lake. Provide financial incentives and cost-share.
- **Outreach to Lawn Care Providers -** Consider offering education and outreach or incentives to lawn care providers to use or offer no-phosphorus fertilizer and to promote soil testing as an option to customers. Provide flyers and other information to lawn care providers to share with their customers that explain the benefits of no-phosphorus fertilizer on the health of their watershed.
- **Urban Wildlife Management** – Establish tall grass buffers around Easter Lake, lower Yeader Creek, and the detention structure in the Southeast Subbasin to limit use by waterfowl.
- **Rooftop and Parking Lot Disconnects** – Establish a program to educate residents, property owners, and business owners on the value of disconnecting runoff from gutters and parking lots and re-routing runoff to appropriate vegetated areas. Provide education and outreach on the value of these practices and financial incentives to implement the practice.
- **Invasive Species Removal** – Heavy infestations of invasive vegetation, such as honeysuckle, can lead to a lack of vegetative diversity below forested areas in the watershed. Invasive species can grow densely and spread rapidly, chocking out native vegetation. This can lead to barren ground cover during non-growing months leaving the ground vulnerable to erosion during heavy rains and snowmelt which carries sediment and other pollutants into the lake. Project sponsors, led by PCCD, should remove invasive vegetation from under forested areas and reestablish stands of native vegetation. Invasive species removal is recommended using tree sheering, drum mowing of honeysuckle, spraying and fire control.
- **Easter Lake Coordinator** – Create a position utilizing available grant funds to hire a coordinator to lead implementation activities, information and education, and to provide technical assistance to property owners. This position will also focus on urban conservation and environmental education from 2013 through the end of the plan.

Policy Based Priorities

Policy and regulatory based strategies can be used to create and enforce ordinances and guide land-use decisions and actions that will protect the environment and improve water quality. Below are key policy based actions intended to reduce pollutant loading to Easter Lake:

- **Detention Pond Public Setbacks –** The City of Des Moines and PCCD should lead an effort to educate residents, property owners, and developers in the Southeast Subbasin about the importance of the proper use and maintenance of the detention structures to optimize water quality benefits. Additionally, the City of Des Moines should maintain the public setbacks around each detention pond to reduce shoreline erosion, limit nutrient loading from lawn maintenance, hinder use of waterfowl, and maintain adequate space for the operation of machinery necessary for pond maintenance.

- **Construction Stormwater Regulation Enforcement –** As development and redevelopment activities occur, especially in the Lake and Southeast subbasins, the City should proactively enforce stormwater and construction runoff regulations. Through the use of appropriate erosion control BMPs on construction sites, large amounts of sediment in stormwater runoff can be prevented from entering the detention structures, and eventually Easter Lake. Enforcement should focus on placement of BMPs by responsible parties as described in the City of Des Moines MS4 permit.

- **Incorporation of Water Quality Elements into Flood Control and Maintenance Projects –** The City, PCCB, and other stakeholders should consider water quality during planning for maintenance projects in the Easter Lake watershed. Examples include:
  - Incorporation of a bioswale to capture runoff from new parking lots
  - Use of permeable pavement systems when replacing parking lots, driveways, and residential streets.
  - Retrofitting existing dry detention structures to incorporate water quality benefits (e.g. native vegetation, extended detention basin, etc.)

7.7. Schedule and Milestones

The effectiveness of the aforementioned BMPs at reducing nutrient and sediment loads into Easter Lake are difficult to estimate. Their effectiveness depends on extent, placement, receptiveness of watershed residents, maintenance and permanence, sub-watershed characteristics, and associated advisory and funding programs. Although values published in the literature are highly variable, they suggest that these techniques may be very effective at reducing nutrient and phosphorus loads to receiving waters. Estimated costs are difficult to calculate due to numerous unknowns; therefore, we do not provide cost estimates for these management techniques.

Project milestones have been established to identify anticipated times in which key components of each Phase are to be started. As the implementation process unfolds, the project sponsors can use these milestones to determine their progress at that time. Milestones have been established for each year of the Plan and include significant actions.

Table 7-9: Overall Schedule and Milestones

Milestone	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
319 Applications	October	April	X	X	X	X	X	X	X	X
Stream Restoration Projects		X	X	X	X	X				
Watershed Projects		X	X	X	X	X	X	X	X	X
Water Quality Coordinator		X	X	X	X	X	X	X	X	X
Programmatic BMPs		X	X	X	X	X	X	X	X	X
In-lake Designs		X	X							
In-lake Contractor Selection			X							
Fishery Renovation Activities				X		X				
Lower lake 8-feet				X						
In-Lake construction				X	X	X				
New Detention Structures						X	X			
Watershed Structural		X	X	X	X	X	X	X	X	X
In-lake Monitoring (post-construction)							X	X	X	X
Routine Monitoring		X	X	X	X	X	X	X	X	X

7.8. Public Involvement Strategy

The primary mechanism in effective plan implementation is changing how people living in and around Easter Lake manage their property. This can be achieved through a strong education and outreach effort. Section 2 – Public Participation and Education discusses efforts which occurred during plan development. This section discusses actions to be taken over the next 10-years to ensure the public is involved, educated, and that collectively their actions have a positive impact on Easter Lake's water quality.

7.8.1. Target Audience

Several groups of stakeholders have an interest in the health of Easter Lake, especially given the lake is located in an urban setting. Residents and visitors of the watershed also have a vital role in the lake rehabilitation and watershed improvement effort. It will be important to include a diverse group in the public involvement strategy. The list below identifies key groups to be included as the target audience:

- Agricultural property owners
- Developers
- Agricultural producers
- Watershed residents and property owners
- Visitors
- Business owners
- City of Des Moines
- Polk County
- Schools

7.8.2. Key Stakeholders

Involvement by several resource agencies and organizations is necessary in order to carry out programs and actions recommended in the plan. These are listed below:

- **Iowa Department of Natural Resources** – funding, fisheries, lake rehabilitation, facilitation, signage
- **Polk County Conservation Board** – funding, outreach, facilitation, signage
- **Polk Soil and Water Conservation District** – coordination, outreach, funding, environmental education, urban conservation
- **City of Des Moines Public Works and Parks and Recreation Departments** – funding, project management, technical assistance
- **Natural Resources Conservation Service** – technical assistance, cost-share
- **Izaak Walton League** – facilitation, program outreach, volunteers

7.8.3. Communication Methods

Outreach to the public can be communicated in several ways. The following are recommended to be used to communicate efforts underway:

- Des Moines Register
- City of Des Moines Public Information Office Quarterly Newsletter
- Neighborhood Association Meetings and Newsletters
- Local Radio Stations
- Resource agency websites (PCCB, Polk SWCD, City of Des Moines, IDNR)

7.8.4. Strategy and Tactics

Adequate attendance at public involvement events can be challenging and is vital to spread the word about available projects and programs as part of this plan and ensure people know about the importance of improving Easter Lake. There are several barriers to consider and incentives to offer that can increase the attendance at events. Below are several considerations when organizing events:

Barriers

- Absentee property owners – several parcels are used as rentals and several of the agricultural parcels are owned by developers.
- Regulatory perception – although the majority of actions in the plan are voluntary, the public may perceive this as being a regulatory action.
- Agriculture BMPs – due to the likelihood of development in the Southeast Subbasin, property owners may be hesitant to utilize cost-share and incentives for any permanent structures such as terraces or grassed waterways.
- Maintenance – property owners may be unwilling to attend events because they may be unwilling to maintain residential BMPs.
- Timing of meetings – scheduling can always be a barrier. Consider multiple short presentations at each event (e.g. two 15-minutre presentations during a two hour open house, instead of one long presentation).

Incentives

- Giveaways – provide coupons, products, and other items as an incentive for attending events (e.g. one free bag of no-phosphorus fertilizers to meeting attendees or give away materials necessary to disconnect downspouts)

- Food – provide meals, snacks, refreshments at events. Grill hot dogs at the 'Easter Lake re-grand opening event'.
- Advertising – utilize creative advertising to encourage attendance.
- Personalized invitations – send letters of invite to the target audience.
- Cost-share – provide cost-share for water quality BMPs for those who attend public events.
- Explain the economic benefits Easter Lake brings to the local economy, the importance of investing into the lake restoration, and the uniqueness of the location of Easter Lake.

7.8.5. Action Items

The list below is a composite of ideas that can be utilized to involve the public in the implementation process. This list has been separated into three groups: education and outreach, partnership, and information.

Education and Outreach

1) Press releases – provide information to newspapers, neighborhood organizations, and other entities describing the Easter Lake water quality improvement efforts. Provide updates to these groups during construction of projects. Advertise the availability of programs, cost-share, and financial incentives for property owners.
2) Easter Lake Improvement Association – continuation of the steering committee to provide implementation oversight from the citizens perspective, meeting twice per year or prior to major milestones
3) Outreach to Neighborhood Associations – Utilize the area neighborhood associations to share information about cost-share, programs, and incentives for property owners.
4) Public Open House Events
    a. Focused on major renovation events (draw down, excavation, west-arm forebay)
    b. Three Lakes Estates education
5) Classes at Easter Lake – rain barrels, rain gardens, etc.
6) Water quality education activities – fishing clinics, kayak or canoe classes. Focus on behavior-changing actions people can do to improve water quality. Incorporate actions for class attendees that include service work, such as litter pick-up, beach clean-up, etc. in exchange for coupons and giveaways.

Partnership

1) Maintain an active Technical Advisory Team – continue to meet regularly throughout the implementation timeline to ensure a collaborative work effort.
2) Involvement through Elementary Schools – include youth in lake restoration and watershed improvement activities such as planting rain gardens, native vegetation maintenance, litter pick-up, shoreline and beach clean-up, etc.
3) Involvement with clubs and organizations – utilize local groups such as the Izaak Walton League
4) Promote Certified Rainscapers in Easter Lake watershed
5) Multi-agency clean up events - Polk SWCB, PCCB, City clean up events including education. Consider a joint event with Izaak Walton League Save Our Streams committee.
6) Dog at the Park Day – provide programming related to pet waste reduction. Focus a program on water quality benefits of properly disposing pet waste. Give away dog snacks and pet waste pick up bags as an incentive to attendees.

Information

1) Develop an active website – showcase the lake renovation, provide information on projects including schedules and timelines, project sponsors, funding sources, etc.
2) Signage / Informational Kiosk – during lake renovation, construct a kiosk at a key point near the lake providing information on planned and current projects. Place several signs at key points in the watershed (South Side Library, trail ways) describing the Easter Lake Water Quality Improvement Project (or similar). Consider placing signage or advertisements at the Des Moines International Airport. Construct signage at the Ewing Dog Park explaining the water quality benefits of picking up pet waste at home.
3) Newsletters – annual newsletters showcasing Easter Lake watershed projects
4) Bill stuffers – utilize bill stuffers as part of the City's monthly billing for utilities.
5) Tours - Provide annual tours highlighting water quality / fishery renovations (kayak/walking tours)

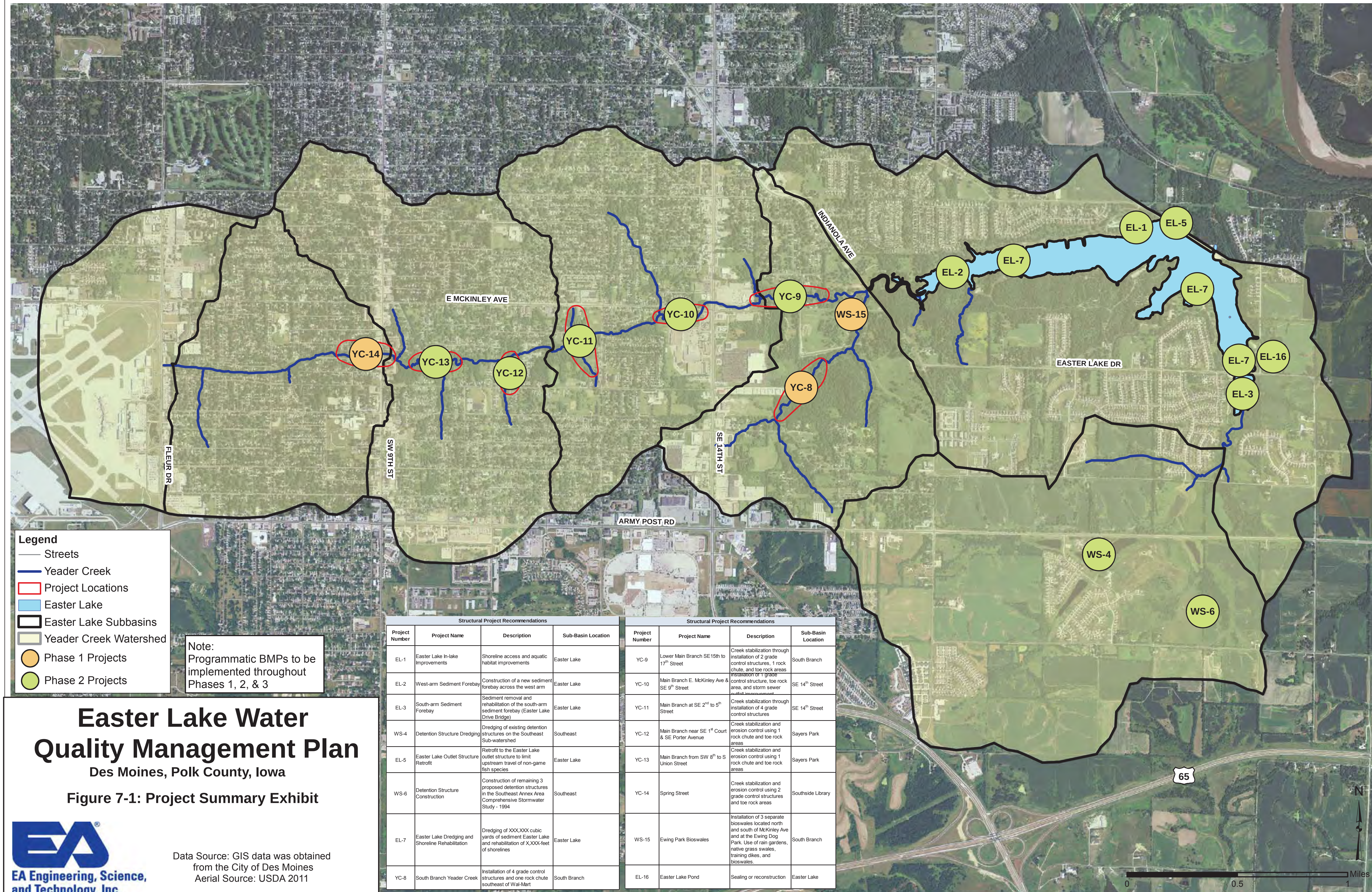
7.8.6. Evaluation

Measuring the effectiveness of education and outreach can be completed several different ways and can be an evaluation criteria for showing the effectiveness of programmatic BMPs utilized in this plan. Below are several methods that can be used to evaluate the public involvement strategy:

- Utilize sign-in sheets to tally total attendance of events over time. Appoint someone to keep a record of attendance overtime.
- Provide opportunities for the public to deliver input on projects and programs at public events.
- Use follow-up surveys, both mail and online, to gather information
- Follow-up with phone calls
- Take lots of pictures at public events

7.9. Structural Project Descriptions

Projects outlined below include a variety of structural improvements located within Easter Lake, Yeader Creek, and the entire watershed. Many of these projects will greatly reduce the amount of sediment and phosphorus loading to the streams and lake. A majority of these projects are located on public property. Figure 7-1: Project Summary Exhibit shows the location of all recommended structural projects by the Phase in which they are recommended to be implemented. Programmatic BMPs are not individually recognized in Figure 7-1 as they are recommended in all three Phases. Figure 7-2: 2012 Bathymetric Survey illustrates the 2012 bathymetric survey and what the lake might appear like when lowered 8-feet, a primary action of this plan in order to construction activities mentioned in this plan.



Legend
- Streets
- Yeader Creek
- Project Locations
- Easter Lake
- Easter Lake Subbasins
- Yeader Creek Watershed
- Phase 1 Projects
- Phase 2 Projects

Note:
Programmatic BMPs to be implemented throughout Phases 1, 2, & 3

Easter Lake Water Quality Management Plan

Des Moines, Polk County, Iowa

Figure 7-1: Project Summary Exhibit

EA Engineering, Science, and Technology, Inc.

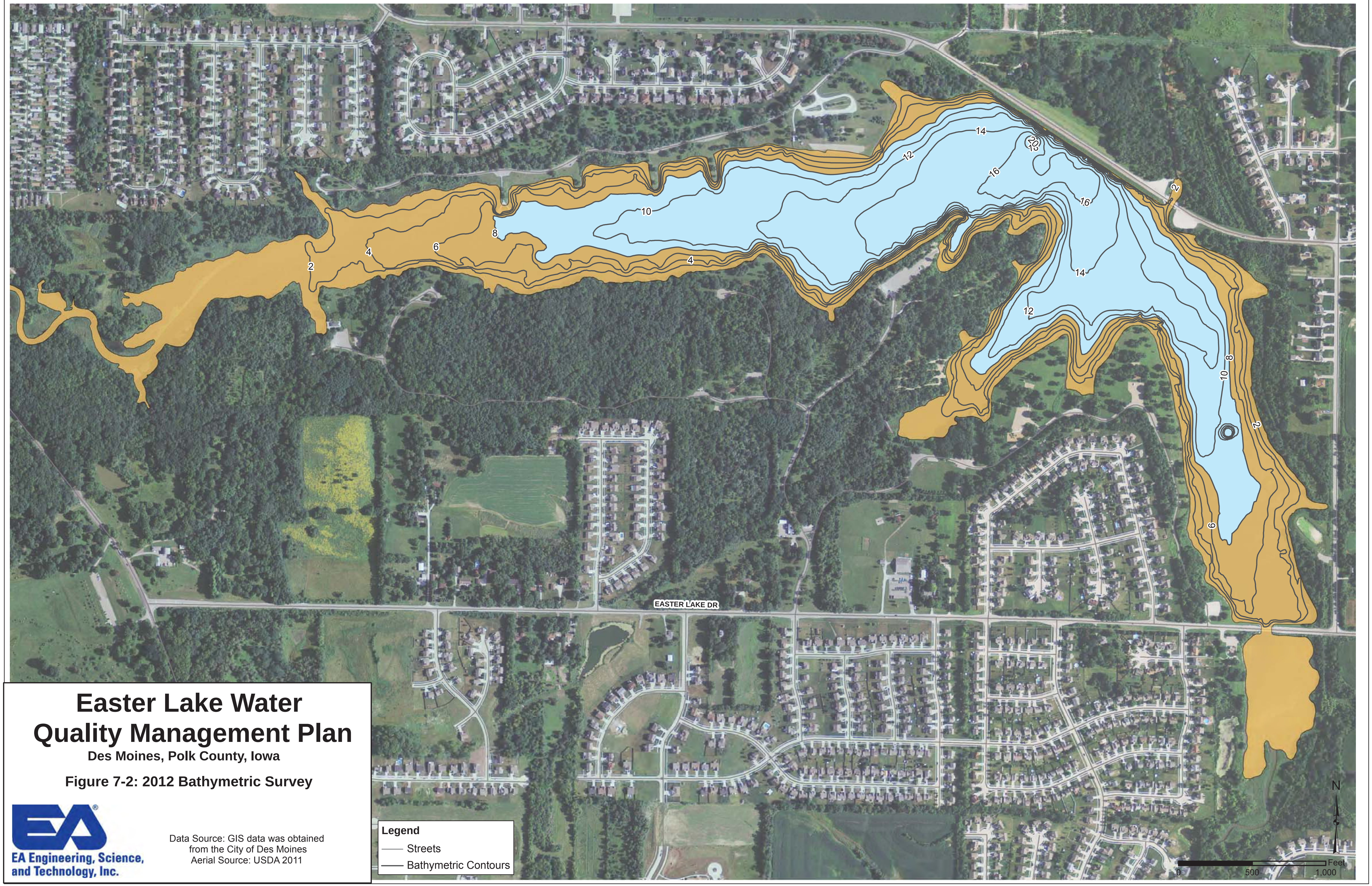
Data Source: GIS data was obtained from the City of Des Moines
Aerial Source: USDA 2011

Structural Project Recommendations

Project Number	Project Name	Description	Sub-Basin Location
EL-1	Easter Lake In-lake Improvements	Shoreline access and aquatic habitat improvements	Easter Lake
EL-2	West-arm Sediment Forebay	Construction of a new sediment forebay across the west arm	Easter Lake
EL-3	South-arm Sediment Forebay	Sediment removal and rehabilitation of the south-arm sediment forebay (Easter Lake Drive Bridge)	Easter Lake
WS-4	Detention Structure Dredging	Dredging of existing detention structures on the Southeast Sub-watershed	Southeast
EL-5	Easter Lake Outlet Structure Retrofit	Retrofit to the Easter Lake outlet structure to limit upstream travel of non-game fish species	Easter Lake
WS-6	Detention Structure Construction	Construction of remaining 3 proposed detention structures in the Southeast Annex Area Comprehensive Stormwater Study - 1994	Southeast
EL-7	Easter Lake Dredging and Shoreline Rehabilitation	Dredging of XXX,XXX cubic yards of sediment Easter Lake and rehabilitation of X,XXX-feet of shorelines	Easter Lake
YC-8	South Branch Yeader Creek	Installation of 4 grade control structures and one rock chute southeast of Wal-Mart	South Branch

Structural Project Recommendations

Project Number	Project Name	Description	Sub-Basin Location
YC-9	Lower Main Branch SE15th to 17th Street	Creek stabilization through installation of 2 grade control structures, 1 rock chute, and toe rock areas	South Branch
YC-10	Main Branch E. McKinley Ave & SE 9th Street	Installation of 1 grade control structure, toe rock area, and storm sewer outfall improvement	SE 14th Street
YC-11	Main Branch at SE 2nd to 5th Street	Creek stabilization through installation of 4 grade control structures	SE 14th Street
YC-12	Main Branch near SE 1st Court & SE Porter Avenue	Creek stabilization and erosion control using 1 rock chute and toe rock areas	Sayers Park
YC-13	Main Branch from SW 8th to S Union Street	Creek stabilization and erosion control using 1 rock chute and toe rock areas	Sayers Park
YC-14	Spring Street	Creek stabilization and erosion control using 2 grade control structures and toe rock areas	Southside Library
WS-15	Ewing Park Bioswales	Installation of 3 separate bioswales located north and south of McKinley Ave and at the Ewing Dog Park. Use of rain gardens, native grass swales, training dikes, and bioswales.	South Branch
EL-16	Easter Lake Pond	Sealing or reconstruction	Easter Lake



Easter Lake Water Quality Management Plan

Des Moines, Polk County, Iowa

Figure 7-2: 2012 Bathymetric Survey

EA Engineering, Science, and Technology, Inc.

Data Source: GIS data was obtained from the City of Des Moines
Aerial Source: USDA 2011

7.10. Easter Lake Project Descriptions

Project EL-1: Easter Lake In-lake Improvements

The project is located within Easter Lake as shown in Figure 7-5: Shoreline Access and Aquatic Habitat (EL-1) & Outlet Retrofit (EL-5). The project includes breakwaters to protect the banks from wave action and provide angler access. It also includes and several scallops, shoals, and rubble piles to provide aquatic habitat.

Ownership:

The project area is on public property.

Site Selection:

Aquatic habitat enhancement sites were selected based on the accessibility of the area.

Project Summary:

The project includes three breakwaters and numerous rubble piles and scallops. The breakwaters are jetties that extend two feet above the water surface to dissipate wave action energy and allow angler access. The breakwaters have a 12 foot wide flat top and 2.5:1 side slopes. The breakwaters are armored with rock rip rap from two feet below the water surface to the top of the breakwater. The top of the breakwaters are surfaced with crushed rock. See Figure 7-3: Typical Breakwater Cross Section for the breakwater detail.

Scallops and rubble piles are placed throughout the lake to provide aquatic habitat. The scallops are constructed by excavating 10' wide, 4' deep areas in the lake near the shoreline as shown in Figure 7-4: Shoreline Scallop. The shoals are mounds next to the scallops that are constructed with the material excavated for scallop construction. Rubble piles are 8 foot diameter 3 foot tall piles of broken concrete rip rap or other recycled rip rap material placed near the shoreline.

Maintenance:

The breakwaters are recommended to be periodically inspected to determine if the rock rip rap and the crushed rock is in place. If the rock rip rap or crushed rock is displaced it is recommended to be replaced.

Estimated Total Project Cost:

Item	Estimated Cost
Mobilization	$10,000
Aquatic Habitat	$35,000
3 Breakwaters	$140,000
Engineering	$15,000
Total	$175,000 - $225,000

The costing of this project assumes it will be constructed in conjuncture with EL-7.

Water Quality Benefits:

Reduction of shoreline erosion through reduced wave action.

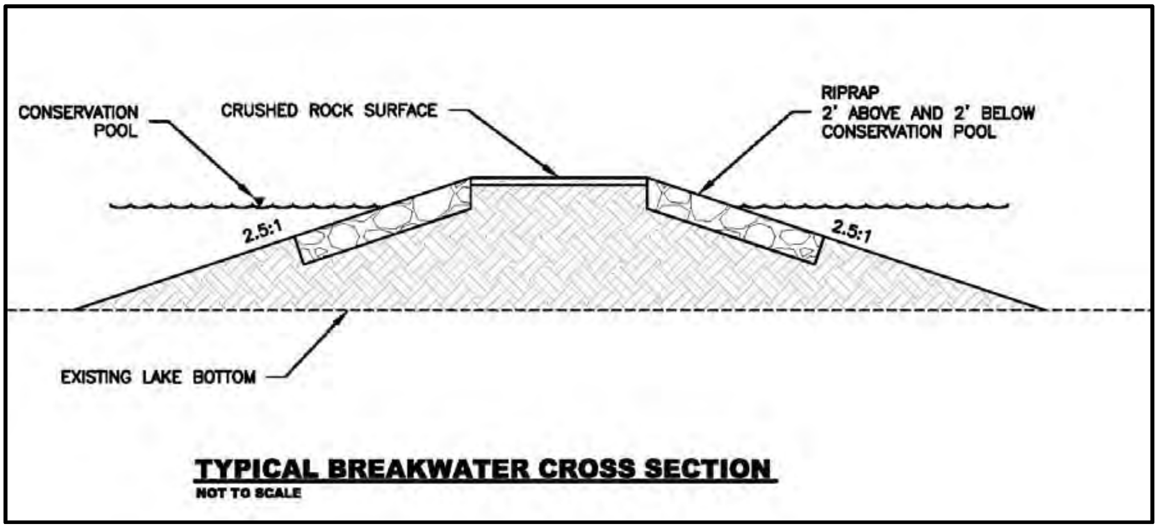


Figure 7-3: Typical Breakwater Cross Section

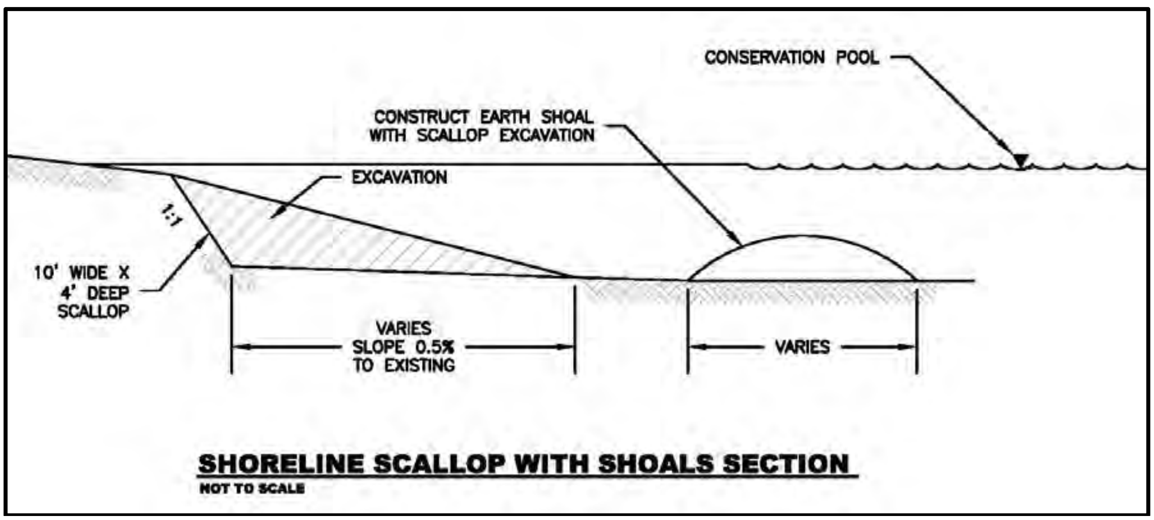
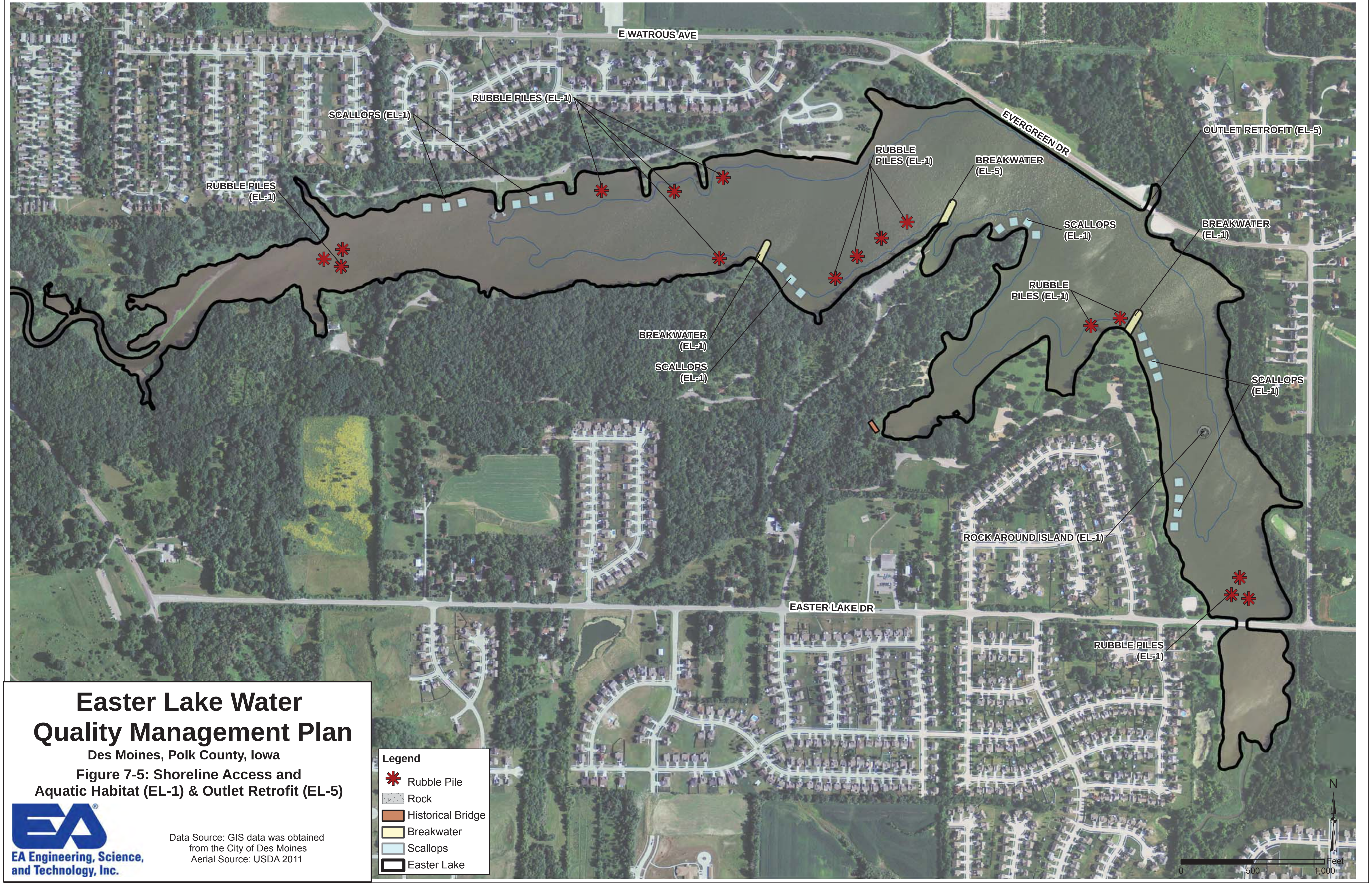


Figure 7-4: Shoreline Scallop



Easter Lake Water Quality Management Plan

Des Moines, Polk County, Iowa

Figure 7-5: Shoreline Access and Aquatic Habitat (EL-1) & Outlet Retrofit (EL-5)

EA Engineering, Science, and Technology, Inc.

Data Source: GIS data was obtained from the City of Des Moines
Aerial Source: USDA 2011

Project EL-2: West-Arm Sediment Forebay

The project is located on the west arm of Easter Lake as shown in Figure 7-6: West Arm Sediment Forebay (EL-2). The project creates an area to trap sediment in the west arm of the lake before it enters the main area of the lake which improves water quality and reduces future maintenance costs.

Ownership:

The project area is on public property.

Site Selection:

The site was selected because it is the location that Yeader Creek enters the lake carrying the majority of watershed sediment and phosphorus loads.

Project Summary:

The project includes deepening the west arm of the lake and constructing dikes to create a sediment forebay. Approximately 10 acres of the lake west of the new dikes are deepened to a mean depth of 6.5 feet. The center 25 percent of the area is 8 foot deep and the remainder of the 10 acres is 6 feet deep. Further west of the 6.5 feet mean depth area, an approximately 6.5 acre area of the lake will be re-shaped and deepened to 3 feet of depth. Dikes that extend 4.5 feet above the water surface are placed east of the deepened area to trap sediment in the project area and dissipate wave action energy. The dikes have a 12 foot wide flat top and 3:1 side slopes. The side slopes are armored with rock rip rap from two feet below the water surface to two feet above the water surface and are protected above the rip rap to the top of the dike by permanent turf reinforcement mat and vegetation. The top of the dikes are surfaced with crushed rock. A weir is constructed between the dikes to create the sediment capture area while allowing high flows to pass through without flooding. The top of the weir is 3 feet below the water surface. The top of the weir is 10 feet wide, the upstream side slope is 3:1, and the downstream side slope is 6:1. The weir will be stabilized with rip rap to protect it from the flows across it.

The sediment capture areas will provide an estimated 36 years of capacity using current pollutant loading estimates and 53 years of capacity using the estimated pollutant loading after the Yeader Creek projects are completed. This assumes the sediment in the forebay needs to be removed when sediment levels reach 3 feet and that 30% sediment load will be transported to the lake. See Figure 7-8: Forebay Dike Cross Section for the dike detail.

Maintenance:

The dikes are recommended to be periodically inspected to determine if the rock rip rap and the crushed rock is in place. If the rock rip rap or crushed rock is displaced it is recommended to be replaced.

The levels of sediment build up behind the dikes should be monitored yearly for the first five years to ensure proper function of the sediment trap area and to estimate actual loading which will be used to develop a long-term maintenance schedule for the trap.

The sediment and phosphorus removal efficiencies will reduce as sediment fills the forebay. The load reductions are based on the forebay after construction, before its depth is reduced by sediment from the watershed.

Estimated Total Project Cost:

Item	Estimated Cost
Mobilization	$35,000
Forebay Dikes	$130,000
Dredging (~113,000 CY)	$540,000
Engineering	$72,500
Total	$680,000 - $875,000

Water Quality Benefits:

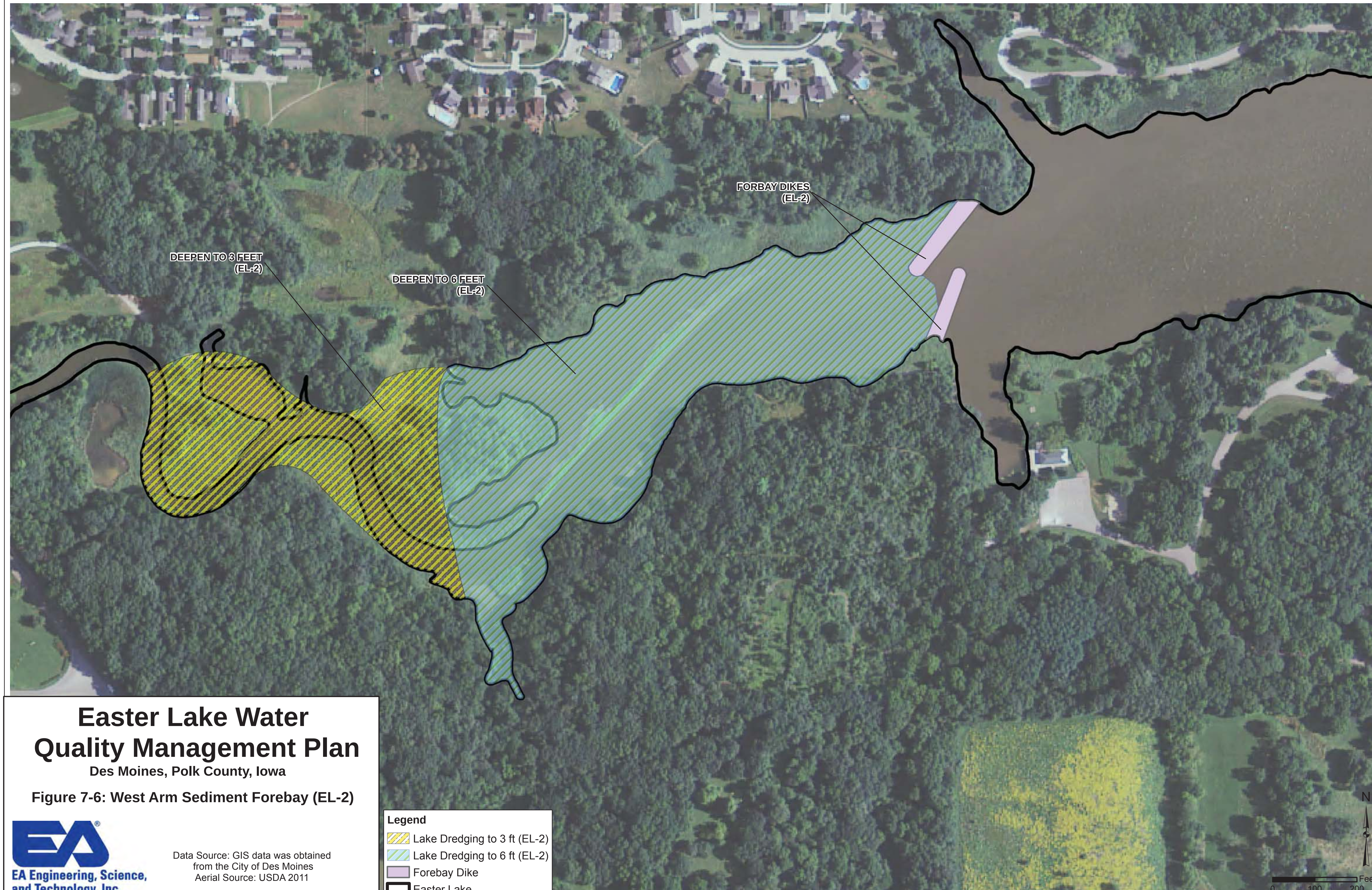
The dikes reduce sediment and phosphorus loading on the main part of Easter Lake by trapping sediment in the project area. The dikes also reduce wave action energy by breaking up waves that crash into them. This reduces sediment loading to the lake by protecting the shoreline from erosion.

Annual Pollutant Load Reduction Estimates for EL-2

Pollutant	Current Pollutant Load to Easter Lake	Anticipated Annual Load Reduction	Percent Annual Reduction
TSS(sediment)	7,000 tons*	2,800 tons*	40%
Phosphorus	4,250	390 pounds	9%**

* Annual reduction based on construction of sediment forebay with the watershed in its current state. As projects and BMPs are completed in the watershed, the annual load and the annual load reduction will be reduced.

** Based on phosphorus reductions from construction of an in-lake detention pond as estimated in the ISU 2011 Diagnostic/Feasibility Study



Easter Lake Water Quality Management Plan

Des Moines, Polk County, Iowa

Figure 7-6: West Arm Sediment Forebay (EL-2)

EA Engineering, Science, and Technology, Inc.

Data Source: GIS data was obtained from the City of Des Moines
Aerial Source: USDA 2011

Project EL-3: South-Arm Sediment Forebay

The project is located on the south arm of Easter Lake as shown in Figure 7-7: South Arm Sediment Forebay (EL-3) . The project restores and improves an area to trap sediment in the south arm of the lake before it enters the main area of the lake which improves water quality and reduces future maintenance costs.

Annual Pollutant Load Reduction Estimates for EL-2

Pollutant	Current Pollutant Load to Easter Lake	Anticipated Annual Load Reduction	Percent Annual Reduction
TSS(sediment)	7,000 tons*	2,600 tons*	37%
Phosphorus	4,250	275 pounds	6%**

* Annual reduction based on construction of sediment forebay with the watershed in its current state. As projects and BMPs are completed in the watershed, the annual load and the annual load reduction will be reduced.
** Based on phosphorus reductions from construction of an in-lake detention pond as estimated in the ISU 2011 Diagnostic/Feasibility Study

Ownership:

The project area is on public property.

Site Selection:

The site was selected because it is the location that the southeast watershed enters the lake.

Project Summary:

The project includes deepening the west arm of the lake south of Easter Lake Drive. Easter Lake Drive restricts the flow into the main part of Easter Lake and creates a sediment forebay south of it. To increase the capacity of the forebay, approximately 9 acres of the lake west of the new dikes are deepened to a mean depth of 6.5 feet. The center 25 percent of the area is 8 foot deep and the remainder of the 9 acres is 6 feet deep. Further south of the 6.5 foot mean depth area, an approximately 3 acre area of the lake will be re-shaped and deepened to 3 feet of depth.

The sediment capture areas will provide an estimated 25 years of capacity using pollutant loading estimated by analyzing the bathymetric survey of the detention basins in the Easter Lake's southeast watershed. This assumes the sediment in the forebay needs to be removed when sediment levels reach 3 feet and that 30% sediment load will be transported to the lake.

The project includes deepening the lake in the project area.

Maintenance:

The levels of sediment build up should be monitored yearly for the first five years to ensure proper function of the sediment trap area and to estimate actual loading which will be used to develop a long-term maintenance schedule for the trap.

The sediment and phosphorus removal efficiencies will reduce as sediment fills the forebay. The load reductions are based on the forebay after construction, before its depth is reduced by sediment from the watershed.

Estimated Total Project Cost:

Item	Estimated Cost
Mobilization	$35,000
Dredging (~113,000 CY)	$540,000
Engineering	$45,000
Total	$525,000 - $700,000

Water Quality Benefits:

Flow into the lake from the project area is restricted by Easter Lake Drive, trapping sediment in the project area. This reduces sediment loading on the main portion of Easter Lake. Reduction estimates used in this plan assume that no projects intended to reduce pollutants upstream of the sediment forebay have been implemented.

Annual Pollutant Load Reduction Estimates for EL-3

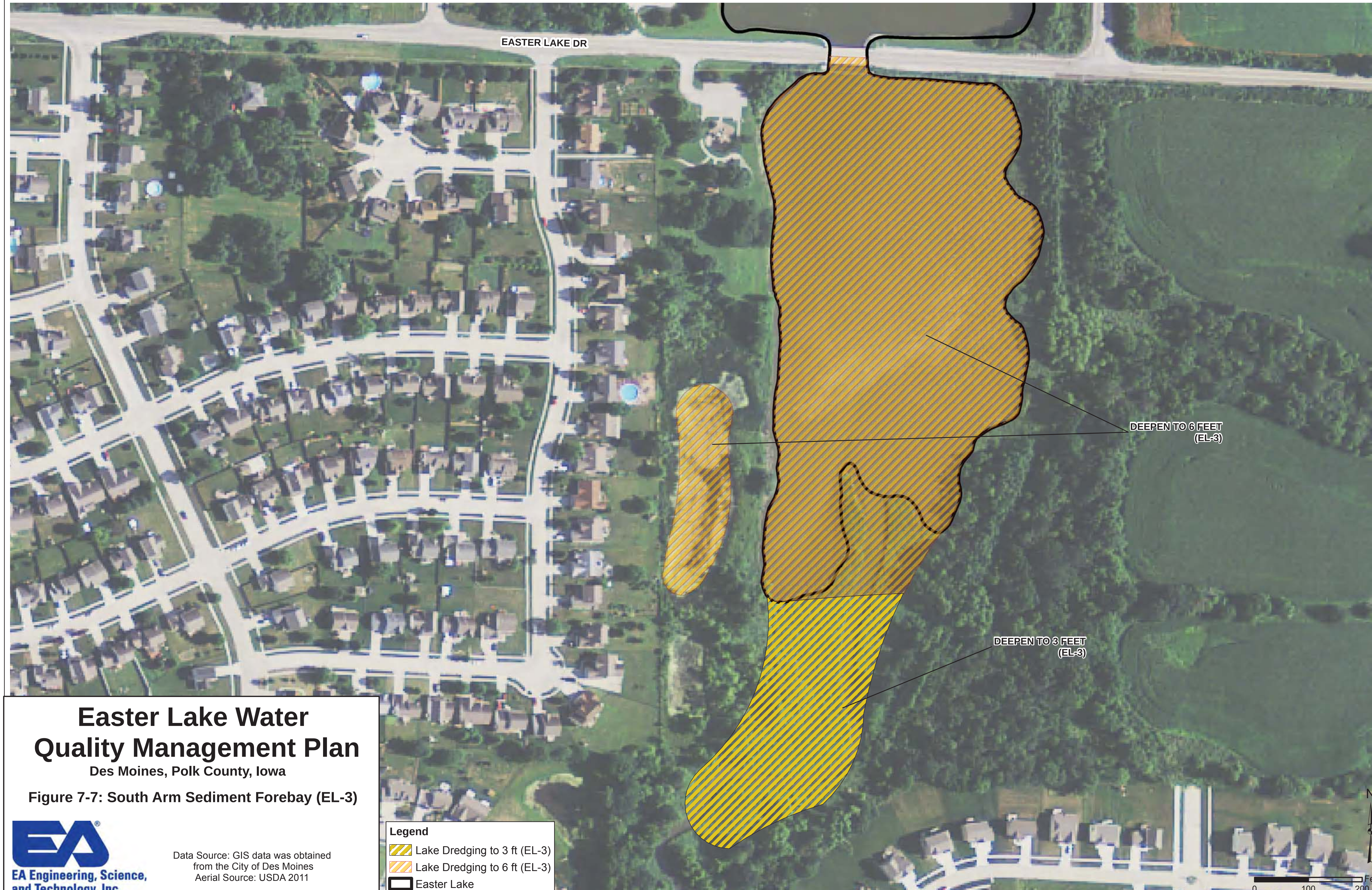
Pollutant	Current Pollutant Load to Easter Lake	Anticipated Annual Load Reduction	Percent Annual Reduction
TSS(sediment)	7,000 tons*	2,600 tons*	37%
Phosphorus	4,250	275 pounds	6%**

* Annual reduction based on construction of sediment forebay with the watershed in its current state. As projects and BMPs are completed in the watershed, the annual load and the annual load reduction will be reduced.
** Based on phosphorus reductions from construction of an in-lake detention pond as estimated in the ISU 2011 Diagnostic/Feasibility Study

Easter Lake Water Quality Management Plan

Des Moines, Polk County, Iowa

Figure 7-7: South Arm Sediment Forebay (EL-3)



EA Engineering, Science, and Technology, Inc.

Data Source: GIS data was obtained from the City of Des Moines
Aerial Source: USDA 2011

Project EL-5: Easter Lake Outlet Structure Retrofit

The project is located within Easter Lake as shown in Figure 7-5: Shoreline Access and Aquatic Habitat (EL-1) & Outlet Retrofit (EL-5). The project retrofits Easter Lake's existing outlet spillway to prevent carp from entering the lake from downstream.

Ownership:

The project area is on public property.

Site Selection:

N/A

Project Summary:

The project includes retrofitting the existing outlet spillway by constructing a low slope section of spillway part way down the existing spillway. The low slope section continues until there is 9 feet of drop from the low slope section to the existing spillway floor. At this location there is a 9 foot tall wall that prevents carp from entering the lake from downstream

Maintenance:

It is recommended that the spillway's structural integrity is periodically inspected.

Estimated Total Project Cost:

Item	Estimated Cost
Mobilization	$15,000
Outlet Structure Retrofit	$145,000
Engineering	$40,000
Total	$185,000 - $215,000

Water Quality Benefits:

The project will improve water quality by reducing the numbers of carp in the lake. The feeding activity of carp uproots aquatic vegetation and re-suspends nutrients leading to turbid water conditions and aquatic vegetation dominated by nuisance algae.

Project EL-7: Easter Lake Dredging and Shoreline Rehabilitation

The project is located within Easter Lake as shown in Figure 7-9: Shoreline Stabilization and Access (EL-7). The project area includes mechanically dredging the lake in several shallow areas and stabilization of approximately 3,600 linear feet of shoreline. Dredging the shallow areas of the lake reduces sediment re-suspension, removes phosphorus and improves water quality. The shoreline stabilization will reduce sediment deposition in the lake by protecting it from erosion. It will also improve angler accessibility. Due to ever changing conditions of shorelines, priority areas for improvement should be reevaluated prior to final design and construction.

Ownership:

The project area is on public property.

Site Selection:

The shoreline stabilization locations were selected based on the rapid shoreline assessment performed by IDNR in August of 2012. Dredging locations were selected to deepen shallow areas in the lake. IDNR conducted a bathymetric survey in 2012 to determine the lake depths.

Project Summary:

The project includes increasing the depth of the lake to 7-8 feet by mechanically dredging in numerous locations to remove phosphorus, reduce sediment re-suspension, and increase water quality. The project also includes shoreline stabilization in numerous locations. The shore is stabilized by re-grading the slope with maximum slop of 3:1 and protecting the slope with permanent turf reinforcement mat and vegetation. The turf reinforcement mat is installed from 2 feet below the water surface to two feet above the water surface.

Maintenance:

The shoreline stabilization areas are recommended to be periodically inspected. It is recommended that gullies and other eroded areas are repaired and re-seeded.

Estimated Total Project Cost:

Item	Estimated Cost
Mobilization	$100,000
Dredging (~225,000 CY)	$1,100,000
Shoreline Stabilization (3,600 LF)	$125,000
Engineering	$130,000
Total	$1,125,000 - $1,600,000

Water Quality Benefits:

Shoreline stabilization reduces sediment loading on Easter Lake by reducing erosion of the lake's banks. Increased depth in shallow areas will reduce sediment re-suspension and increase water clarity. Physical removal of sediment and the attached phosphorus was not calculated into the load reduction estimate.

Annual Pollutant Load Reduction Estimates for EL-7

Pollutant	Current Pollutant Load to Easter Lake	Anticipated Annual Load Reduction	Percent Annual Reduction
Phosphorus	4,250	36 pounds	<1%

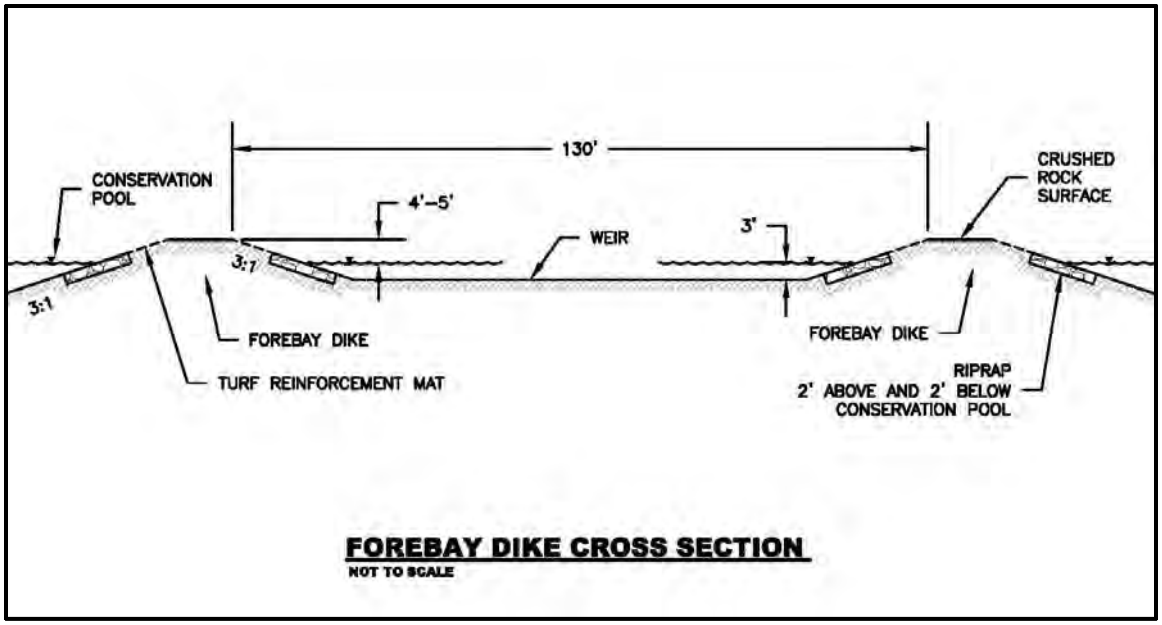
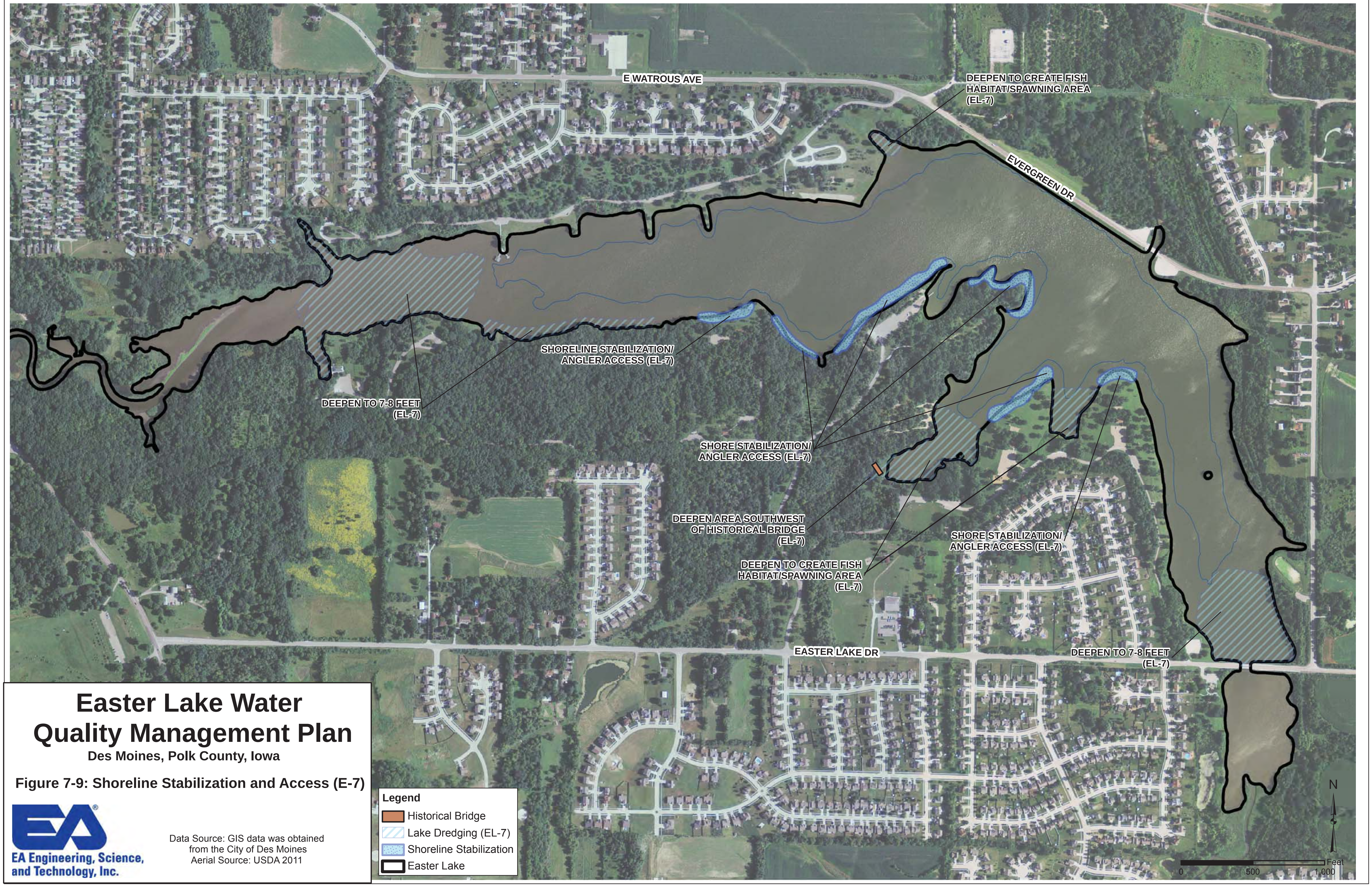


Figure 7-8: Forebay Dike Cross Section



Easter Lake Water Quality Management Plan

Des Moines, Polk County, Iowa

Figure 7-9: Shoreline Stabilization and Access (E-7)

EA Engineering, Science, and Technology, Inc.

Data Source: GIS data was obtained from the City of Des Moines
Aerial Source: USDA 2011

Project EL-16: Easter Lake Rearing Pond

This 0.25-acre rearing pond is used by PCCB and IDNR staff for rearing predator fish species, such as walleye and largemouth bass. The pond is located on the east side of the lake and has an outlet pipe that delivers fish directly to the lake. Water is pumped from the main lake into the pond prior to each rearing session.

Ownership: The project area contains public property.

Site Selection:

The pond is in an area where construction will be occurring during lake renovation making it a good target for improvement while equipment is in the area.

Project Summary:

Water leaks are currently present at the back through the dam (possibly around the outlet pipe), which requires additional attention and pumping throughout the rearing sessions. Due to the presence of multiple contractors at Easter Lake during the renovation period IDNR has added improving the rearing pond to the implementation strategy to avoid mobilization costs in the future. Sealing or reconstruction of the rearing pond dam will be necessary.

Maintenance:

N/A

Estimated Total Project Cost: $35,000

Water Quality Benefits:

N/A

7.11. Yeader Creek Project Descriptions

Yeader Creek projects YC-8 (South Branch Yeader Creek) and YC-14 (Spring Street) are considered higher priority due to the severity of erosion at each site, and in the case of Spring Street the threat to existing infrastructure. Preliminary engineering for each structure at these sites has been provided in this Plan.

The five additional projects sites (YC-9-13) include similar information but do not include the same level of preliminary engineering. The order for implementation for the remaining five projects has not been identified, although typically watershed improvement work begins at the upper portion of the watershed. Due to the dynamic nature of Yeader Creek and its tributaries, each project site will need to be re-evaluated during design to ensure site conditions are similar to the time each project was sited in 2012 and that the water quality benefits share the same intent. There is a distinct possibility that the exact locations described in this Plan may change upstream or downstream from the original location.

Project YC-8: South Branch Yeader Creek

The project is in the south branch of Yeader Creek as shown in Figure Figure 7-10: YC-8 South Branch Yeader Creek. The project area includes 2,200 feet of the south branch of Yeader Creek. The project utilizes grade control structures and a rock chute to stabilize the creek. The grade control structures create shallow pools of water in the creek that will silt in over time. This protects the banks by reducing the channel slope, which reduces the water velocities to minimize erosion. The rock chute protects the creek from erosion by reshaping a section of the creek that includes a nickpoint and armoring the section of the creek with rock rip rap.

Ownership:

The project area contains both public and private property.

Site Selection:

This site was selected due to the stability of the banks and the high average annual sediment load the section of the stream produces. The stream stability and average sediment load were estimated as part of NRCS's August 2010 erosion and sediment delivery study.

Project Summary:

The project includes construction of four grade control structures and one rock chute. The grade control structures are 5 to 6 feet tall berms with a 3:1 side slope on the upstream side and a 10:1 side slope on the downstream side. The grade control structure is reinforced with sheetpiling, as shown in the following Figures, to ensure the structure is not displaced. The grade control structures are also covered in rock rip rap that is keyed in the creek floor to protect the structure from erosion. The grade control structures significantly increase the flow depth in the channel during the 100 year event, but the flow depth will not exceed the creek's banks. The grade control structures' impacts should be further evaluated as part of their final design.

The rock chute reshapes the creek in the area shown on Figure 7-13: Structure #3 YC-8. The nickpoint in the area is removed by sloping the channel at 10% for a distance of 130 feet. The channel is protected from erosion by lining the channel with rock rip rap.

Maintenance:

The grade control structures and the rock chute are recommended to be inspected annually and after large storm events to determine if the rock rip rap is in place for the first five years or until vegetation is well established. If the rock rip rap is displaced it is recommended to be replaced. After the vegetation is established and the upstream pools have begun to silt in, the structures will be very stable and little inspection or maintenance will be required.

Estimated Total Project Cost:

Item	Estimated Cost
Mobilization	$15,000
4 Grade Control Structures	$225,000
1 Rock Chute	$85,000
Engineering	$75,000
Total	$375,000 - $425,000

Water Quality Benefits:

The primary purpose of the project is to reduce sediment loading to Easter Lake. The grade control structures will reduce the flow velocities and increase infiltration by pooling water upstream of the structures. The reduced flow velocities will protect the creek upstream of the structure from headcutting and stream bank erosion; effectively reducing the sediment loading to Easter Lake. The rock chute will also protect the creek from headcutting and stream bank erosion by armoring that section of the creek. The reduction of sediment loading on Easter Lake is shown in a table below. Reducing the sediment loading to Easter Lake will also reduce phosphorus loading by unpredictable quantity.

Annual Pollutant Load Reduction Estimates for YC-8

Pollutant	Current Pollutant Load to Easter Lake	Anticipated Annual Load Reduction	Percent Annual Reduction
TSS(sediment)	7,000 tons*	435 tons	6%
Phosphorus	4,250	35 pounds	<1%

* Annual reduction based on construction YC-8 with the remainder of the watershed in its current state. As projects and BMPs are completed in the watershed, the annual load will be reduced.

Figure 7-10: YC-8 South Branch Yeader Creek

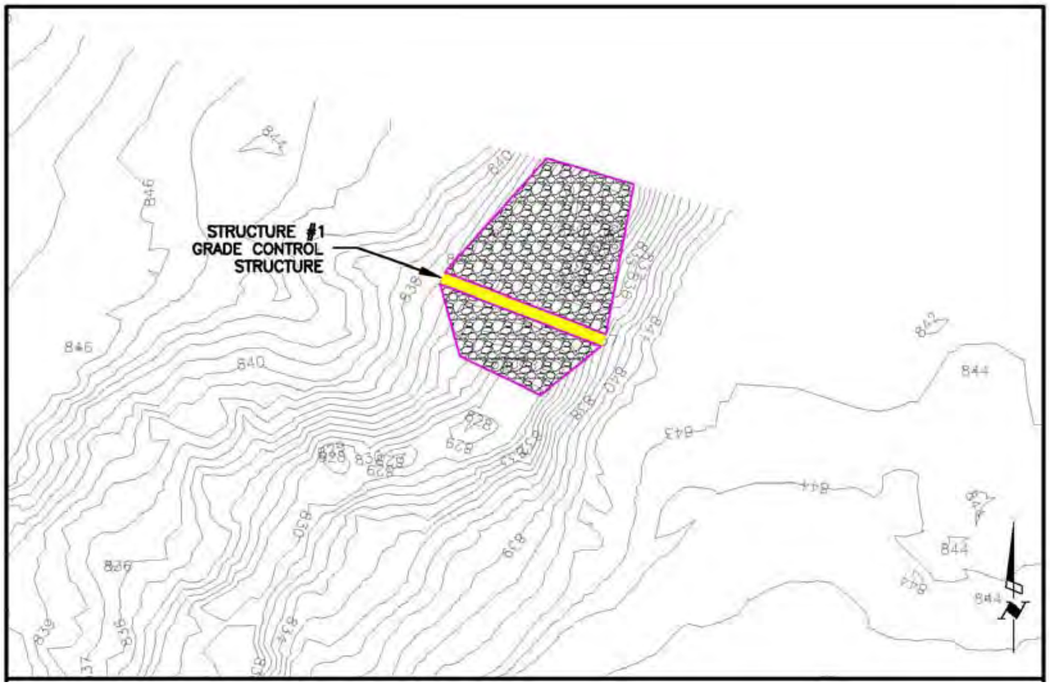


Figure 7-11: Structure #1 YC-8

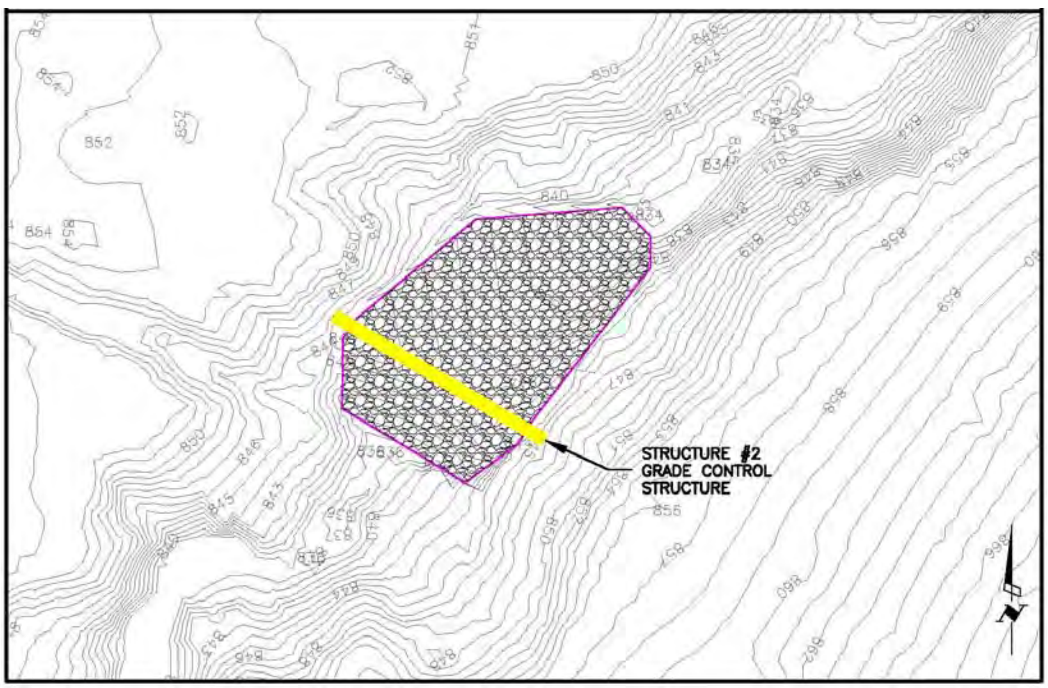


Figure 7-12: Structure #2 YC-8

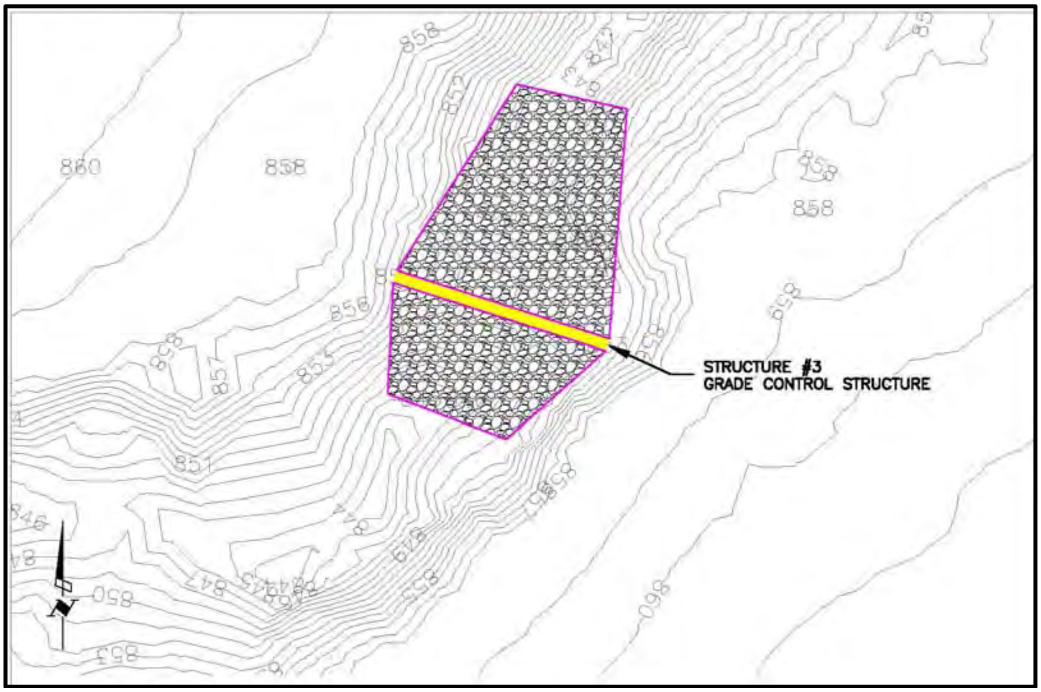


Figure 7-13: Structure #3 YC-8

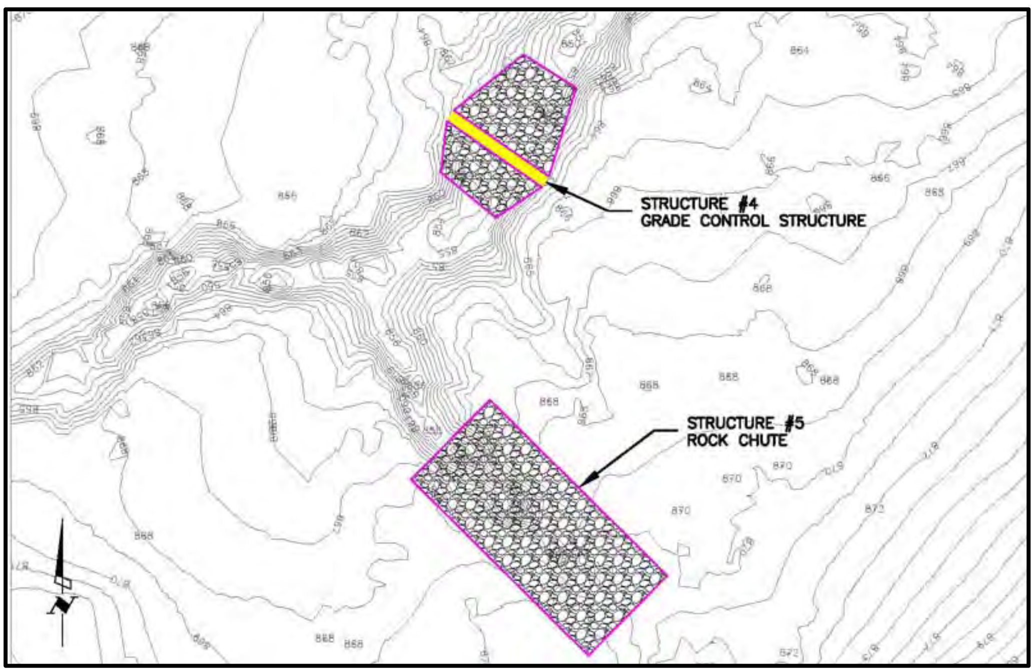


Figure 7-14: Structures #4 & #5 YC-8

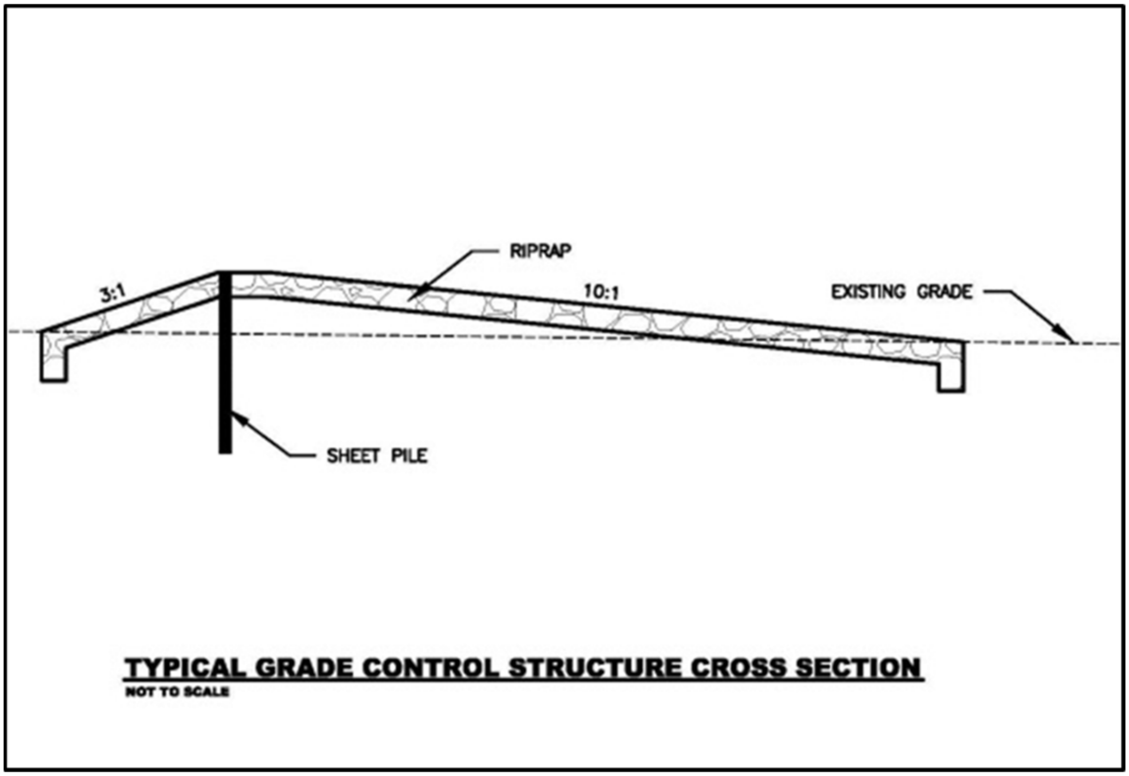


Figure 7-15: Typical Grade Control Structure YC-8

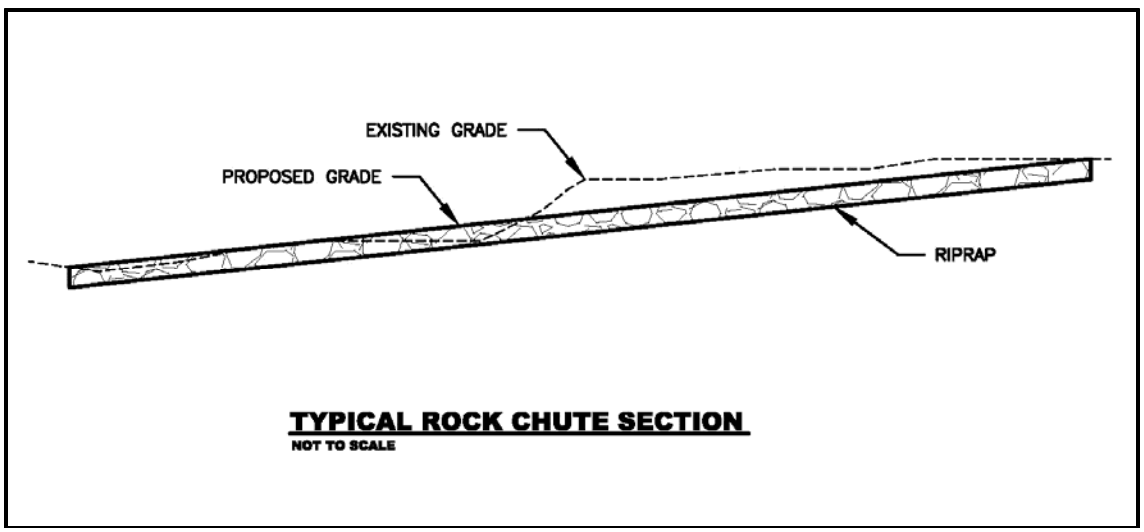


Figure 7-16: Typical Rock Chute YC-8

Project YC-9: Lower Main Branch SE 15th Street to 17th Street

The project is in the main branch of Yeader Creek as shown in Figure 7-17: YC-9 Lower Main Branch SE 15th Street to 17th Street. The project area includes 2,100 feet of the main branch of Yeader Creek. The project utilizes grade control structures, a rock chute, and toe rock to stabilize the creek. The grade control structures create shallow pools of water in the creek that will silt in over time. This protects the banks by reducing the channel slope, which reduces the water velocities to minimize erosion. The rock chute protects the creek from erosion by reshaping the channel where the tributary enters Yeader Creek. The rock chute is armored with rock rip rap to protect from erosion. The toe rock protects the creek from erosion by stabilizing the toe of the bank with rock rip rap. By creating a stable point at the toe of the bank, creek flow is not allowed to undercut the bank.

Ownership:

The project area is on private property.

Site Selection:

This site was selected due to the stability of the banks and the high average annual sediment load the section of the stream produces. The stream stability and average sediment load were estimated as part of NRCS's August 2010 erosion and sediment delivery study.

Project Summary:

The project includes construction of two grade control structures, one rock chute, and 200 linear feet of toe rock. The grade control structures are 2 to 5 feet tall berms with a 3:1 side slope on the upstream side and a 10:1 side slope on the downstream side. The grade control structure is reinforced with sheet piling, to ensure the structure is not displaced. The grade control structures are also covered with rock rip rap that is keyed in the creek floor to protect the structure from erosion. The grade control structures' impacts on channel flow depth during large storm events should be evaluated as part of their final design.

The rock chute reshapes the creek in the area shown in the Figure below. The steep section of stream is protected from erosion by lining the channel with rock rip rap.

The toe rock is rock rip rap placed at the bank. The rip rap extends 3 feet vertically up the bank and is keyed into the channel to prevent undercutting. The rip rap follows the existing slope but should not be placed at a slope steeper than 1.5:1. If the bank slope is steeper than 1.5:1, the bank will need to be reshaped.

Maintenance:

The grade control structures, the rock chute, and toe rock are recommended to be inspected annually and after large storm events to determine if the rock rip rap is in place for the first five years or until vegetation is well established. If the rock rip rap is displaced it is recommended to be replaced. After the vegetation is established and the upstream pools have begun to silt in, the structures will be very stable and little inspection or maintenance will be required.

Estimated Total Project Cost:

Item	Estimated Cost
Mobilization	$8,000
2 Grade Control Structures and Rock Chute	$150,000
Toe Rock (200 LF)	$12,000
Engineering	$40,000
Total	$185,000 - $235,000

Water Quality Benefits:

The primary purpose of the project is to reduce sediment loading to Easter Lake. The grade control structures will reduce the flow velocities and increase infiltration by pooling water upstream of the structures. The reduced flow velocities will protect the creek upstream of the structure from headcutting and streambank erosion; effectively reducing the sediment loading to Easter Lake. The rock chute will also protect the creek from headcutting and streambank erosion by armoring that section of the creek. The toe rock stabilizes toe and protects the side slopes, reducing the sediment that is deposited in the creek. The reduction of sediment loading on Easter Lake is shown on table below. Reducing the sediment loading to Easter Lake will also reduce phosphorus loading by unpredictable quantity.

Annual Pollutant Load Reduction Estimates for YC-9

Pollutant	Current Pollutant Load to Easter Lake	Anticipated Annual Load Reduction	Percent Annual Reduction
TSS(sediment)	7,000 tons*	180 tons	3%
Phosphorus	4,250	15 pounds	<1%

* Annual reduction based on construction YC-9 with the remainder of the watershed in its current state. As projects and BMPs are completed in the watershed, the annual load will be reduced.

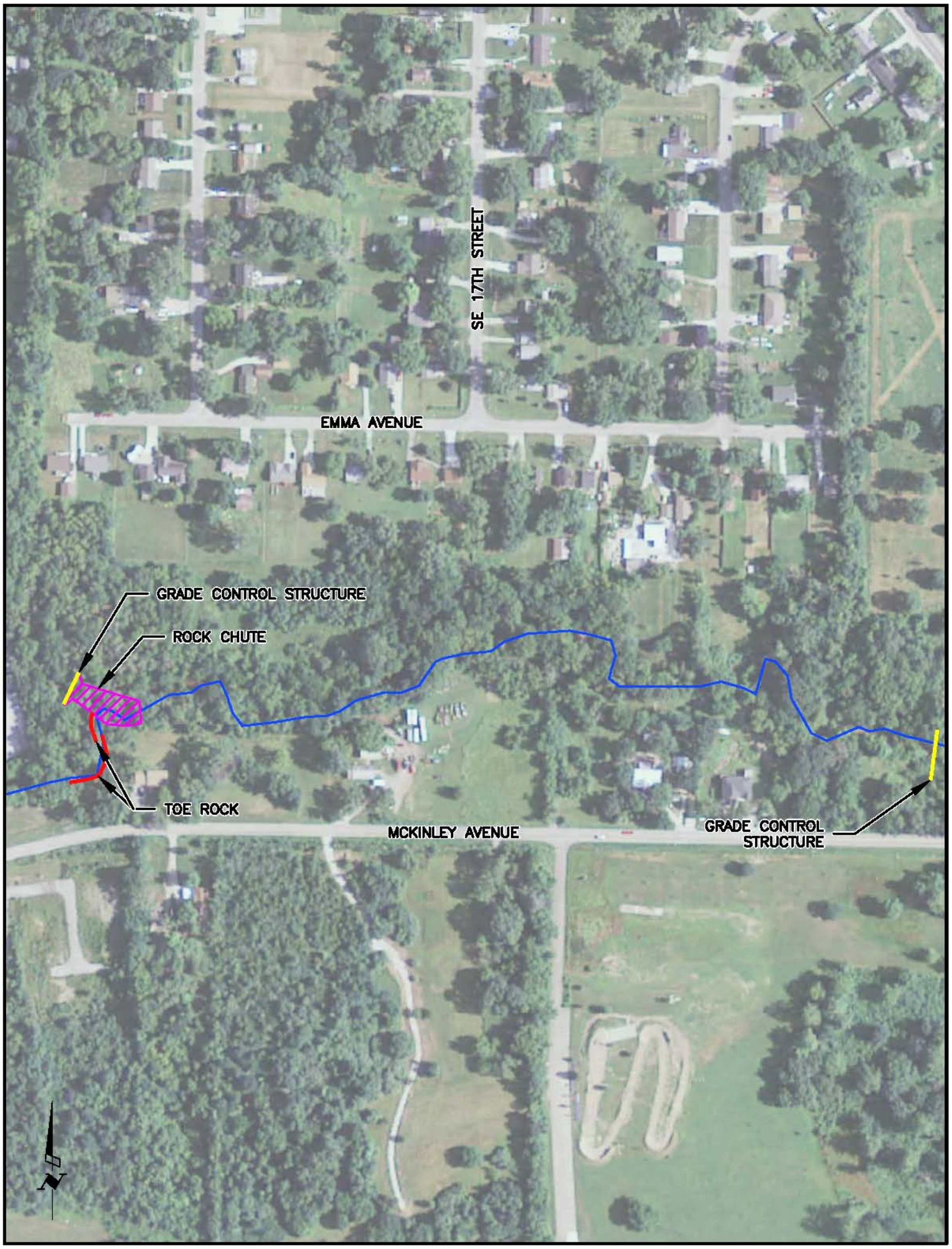


Figure 7-17: YC-9 Lower Main Branch SE 15th Street to 17th Street

Project YC-10: Main Branch at East McKinley Avenue and Southeast 9th Street

This project is in the main branch of Yeader Creek as shown in Figure 7-18: YC-10: Main Branch at East McKinley Avenue and Southeast 9th Street. The project area includes 1,900 feet of the main branch of Yeader Creek. The project includes a grade control structure, a repaired outfall, and toe rock to stabilize the creek. The grade control structure creates a shallow pool of water in the creek that will silt in over time. This protects the banks by reducing the channel slope, which reduces the water velocities to minimize erosion. The outfall shown on Figure 7-19: Typical Outfall Repair YC-10 is severely eroded and the flow out of the pipe is undercutting the bank. Repairing this outfall prevents local erosion that contributes sediment to Easter Lake. The toe rock protects the creek from erosion by stabilizing the toe of the bank with rock rip rap. By creating a stable point at the toe of the bank, creek flow is not allowed to undercut the bank.

Ownership:

The project is on private property.

Site Selection:

This site was selected due to the stability of the banks and the high average annual sediment load the section of the stream produces. The stream stability and average sediment load were estimated as part of NRCS's August 2010 erosion and sediment delivery study.

Project Summary:

The project includes construction of one grade control structure, 375 linear feet of toe rock, and a repaired outfall. The grade control structure is a 4 to 5 feet tall berms with a 3:1 side slope on the upstream side and a 10:1 side slope on the downstream side. The grade control structure is reinforced with sheetpiling to ensure the structure is not displaced. The grade control structure is also covered with rock rip rap that is keyed in the creek floor to protect the structure from erosion. The grade control structure's impact on channel flow depth during large storm events should be evaluated as part of the final design.

The outfall is repaired by extending and redirecting the pipe parallel to channel flow. The pipe outlets to a concrete pad with energy dissipation columns. Beyond the concrete pad, the channel is protected by rock rip rap.

The toe rock is rock rip rap placed at the bank. The rip rap extends 3 feet vertically up the bank and is keyed into the channel to prevent undercutting. The rip rap follows the existing slope but should not be placed at a slope steeper than 1.5:1. If the bank slope is steeper than 1.5:1, the bank will need to be reshaped.

Maintenance:

The grade control structure and toe rock are recommended to be inspected annually and after large storm events to determine if the rock rip rap is in place for the first five years or until vegetation is well established. If the rock rip rap is displaced it is recommended to be replaced. After the vegetation is established and the upstream pools have begun to silt in, the structures will be very stable and little inspection or maintenance will be required.

The outfall should be inspected annually and required maintenance should be completed as necessary.

Estimated Total Project Cost:

Item	Estimated Cost
Mobilization	$7,000
Grade Control Structure	$70,000
Toe Rock (375 LF)	$20,000
Outfall Repair	$60,000
Engineering	$35,000
Total	$165,000 - $215,000

Water Quality Benefits:

The primary purpose of the project is to reduce sediment loading to Easter Lake. The grade control structures will reduce the flow velocities and increase infiltration by pooling water upstream of the structures. The reduced flow velocities will protect the creek upstream of the structure from headcutting and streambank erosion; effectively reducing the sediment loading to Easter Lake. The rock chute will also protect the creek from headcutting and streambank erosion by armoring that section of the creek. The toe rock stabilizes toe and protects the side slopes, reducing the sediment that is deposited in the creek. The outfall repair will stabilize the area downstream of the outfall. The reduction of sediment loading on Easter Lake for project YC-10 is shown in the table below. Reducing the sediment loading to Easter Lake will also reduce phosphorus loading by unpredictable quantity.

Annual Pollutant Load Reduction Estimates for YC-10

Pollutant	Current Pollutant Load to Easter Lake	Anticipated Annual Load Reduction	Percent Annual Reduction
TSS(sediment)	7,000 tons*	200 tons	3%
Phosphorus	4,250	15 pounds	<1%

* Annual reduction based on construction YC-10 with the remainder of the watershed in its current state. As projects and BMPs are completed in the watershed, the annual load will be reduced.

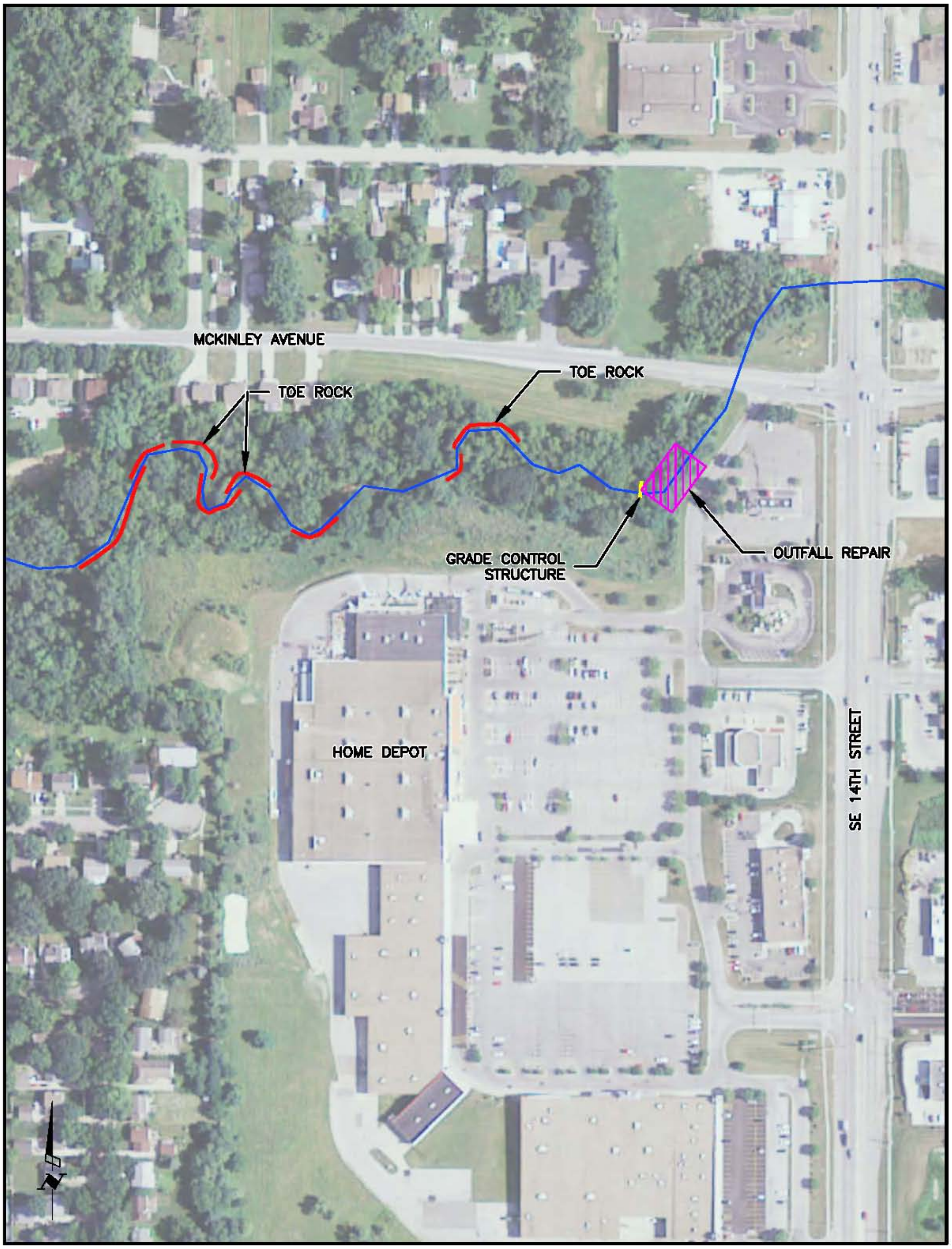


Figure 7-18: YC-10: Main Branch at East McKinley Avenue and Southeast 9th Street

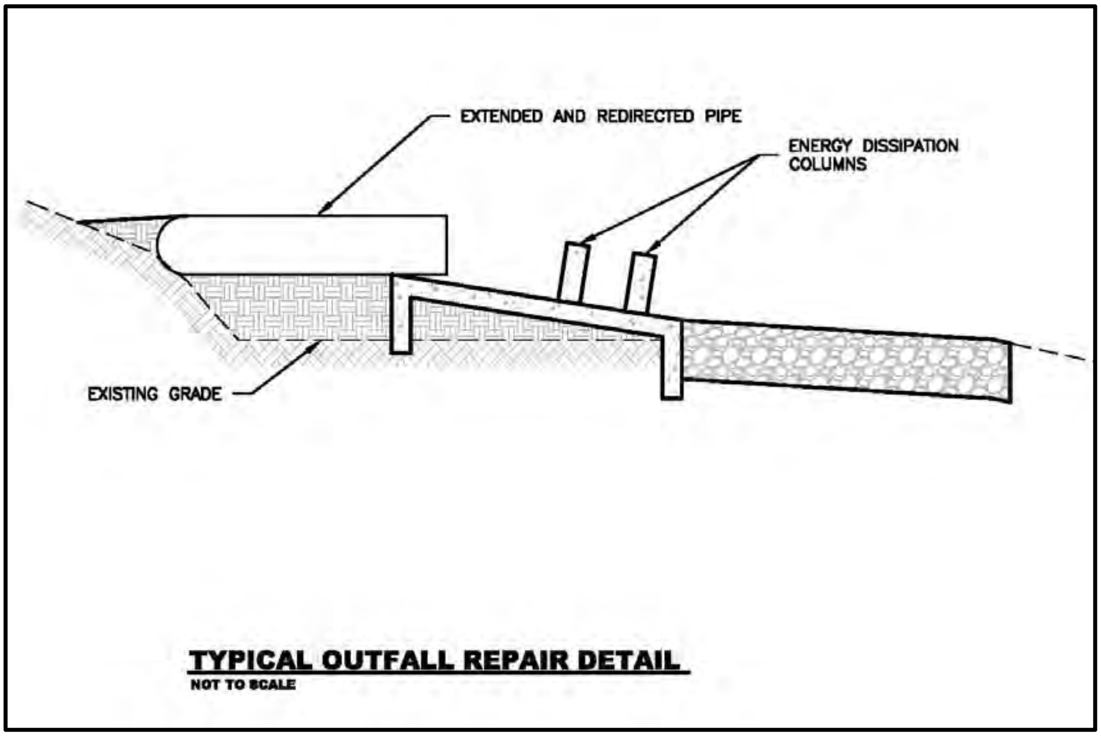


Figure 7-19: Typical Outfall Repair YC-10

Project YC-11: Main Branch at Southeast 2nd Street to 5th Street

This project is in the main branch of Yeader Creek as shown in Figure 7-20: YC-11: Main Branch at Southeast 2nd Street to 5th Street. The project area includes 2,900 feet of the main branch of Yeader Creek. The project includes grade control structures and toe rock to stabilize the creek. The grade control structures create shallow pools of water in the creek that will silt in over time. This protects the banks by reducing the channel slope, which reduces the water velocities to minimize erosion. The toe rock protects the creek from erosion by stabilizing the toe of the bank with rock rip rap. By creating a stable point at the toe of the bank, creek flow is not allowed to undercut the bank

Ownership:

The project area is on private property.

Site Selection:

This site was selected due to the stability of the banks and the high average annual sediment load the section of the stream produces. The stream stability and average sediment load were estimated as part of NRCS's August 2010 erosion and sediment delivery study.

Project Summary:

The project includes construction of four grade control structures 1,000 linear feet of toe rock. The grade control structures are 2 to 3 feet tall berms with a 3:1 side slope on the upstream side and a 10:1 side slope on the downstream side. The grade control structures are reinforced with sheetpiling to ensure the structure is not displaced. The grade control structures are also covered in rock rip rap that is keyed in the creek floor to protect the structure from erosion. The grade control structures' impacts on channel flow depth during large storm events should be evaluated as part of the final design.

The toe rock is rock rip rap placed at the bank. The rip rap extends 3 feet vertically up the bank and is keyed into the channel to prevent undercutting. The rip rap follows the existing slope but should not be placed at a slope steeper than 1.5:1. If the bank slope is steeper than 1.5:1, the bank will need to be reshaped.

Maintenance:

The grade control structure and toe rock are recommended to be inspected annually and after large storm events to determine if the rock rip rap is in place for the first five years or until vegetation is well established. If the rock rip rap is displaced it is recommended to be replaced. After the vegetation is established and the upstream pools have begun to silt in, the structures will be very stable and little inspection or maintenance will be required.

Estimated Total Project Cost:

Item	Estimated Cost
Mobilization	$6,000
Grade Control Structure	$55,000
Toe Rock (1,000 LF)	$55,000
Engineering	$30,000
Total	$120,000 - $170,000

Water Quality Benefits:

The primary purpose of the project is to reduce sediment loading to Easter Lake. The grade control structures will reduce the flow velocities and increase infiltration by pooling water upstream of the structures. The reduced flow velocities will protect the creek upstream of the structure from headcutting and streambank erosion; effectively reducing the sediment loading to Easter Lake. The toe rock stabilizes toe and protects the side slopes, reducing the sediment that is deposited in the creek. The reduction of sediment loading on Easter Lake for project YC-11 is shown below. Reducing the sediment loading to Easter Lake will also reduce phosphorus loading by unpredictable quantity.

Annual Pollutant Load Reduction Estimates for YC-11

Pollutant	Current Pollutant Load to Easter Lake	Anticipated Annual Load Reduction	Percent Annual Reduction
TSS(sediment)	7,000 tons*	225 tons	3%
Phosphorus	4,250	20 pounds	<1%

* Annual reduction based on construction YC-11 with the remainder of the watershed in its current state. As projects and BMPs are completed in the watershed, the annual load will be reduced.

Figure 7-20: YC-11: Main Branch at Southeast 2nd Street to 5th Street

Project YC-12: Main Branch near Southeast 1st Court and Southeast Porter Avenue

This project is in the main branch of Yeader Creek as shown in Figure 7-21: YC-12: Main Branch near Southeast 1st Court and Southeast Porter Avenue. The project area includes 600 feet a tributary of the main branch of Yeader Creek. The project utilizes toe rock and a rock chute to stabilize the creek. The toe rock protects the creek from erosion by stabilizing the toe of the bank with rock rip rap. By creating a stable point at the toe of the bank creek flow is not allowed to undercut the bank. The rock chute protects creek from erosion by reshaping the channel where the channel slope is steep. The rock chute is armored with rock rip rap to protect from erosion.

Ownership:

The project area is on private property.

Site Selection:

This site was selected due to the stability of the banks and the high average annual sediment load the section of the stream produces. The stream stability and average sediment load were estimated as part of NRCS's August 2010 erosion and sediment delivery study.

Project Summary:

The project includes construction of a rock chute and 800 linear feet of toe rock. The toe rock is rock rip rap placed at the bank. The rip rap extends 3 feet vertically up the bank and is keyed into the channel to prevent undercutting. The rip rap follows the existing slope but should not be placed at a slope steeper than 1.5:1. If the bank slope is steeper than 1.5:1, the bank will need to be reshaped.

The rock chute reshapes the creek in the area as shown in project YC-8. The steep section of stream is protected from erosion by lining the channel with rock rip rap.

Maintenance:

The toe rock and rock chute are recommended to be inspected annually and after large storm events to determine if the rock rip rap is in place for the first five years or until vegetation is well established. If the rock rip rap is displaced it is recommended to be replaced. After the vegetation is established the structures will be very stable and little inspection or maintenance will be required.

Estimated Total Project Cost:

Item	Estimated Cost
Mobilization	$6,000
1 Rock Chute	$20,000
Toe Rock (800 LF)	$45,000
Engineering	$20,000
Total	$75,000 - $105,000

Water Quality Benefits:

The primary purpose of the project is to reduce sediment loading to Easter Lake. The rock chute will also protect the creek from headcutting and streambank erosion by armoring that section of the creek. The toe rock stabilizes toe and protects the side slopes, reducing the sediment that is deposited in the creek. The reduction of sediment loading on Easter Lake is shown in the table below for YC-12. Reducing the sediment loading to Easter Lake will also reduce phosphorus loading by unpredictable quantity.

Annual Pollutant Load Reduction Estimates for YC-12

Pollutant	Current Pollutant Load to Easter Lake	Anticipated Annual Load Reduction	Percent Annual Reduction
TSS(sediment)	7,000 tons*	60 tons	<1%
Phosphorus	4,250	5 pounds	<1%

* Annual reduction based on construction YC-12 with the remainder of the watershed in its current state. As projects and BMPs are completed in the watershed, the annual load will be reduced.

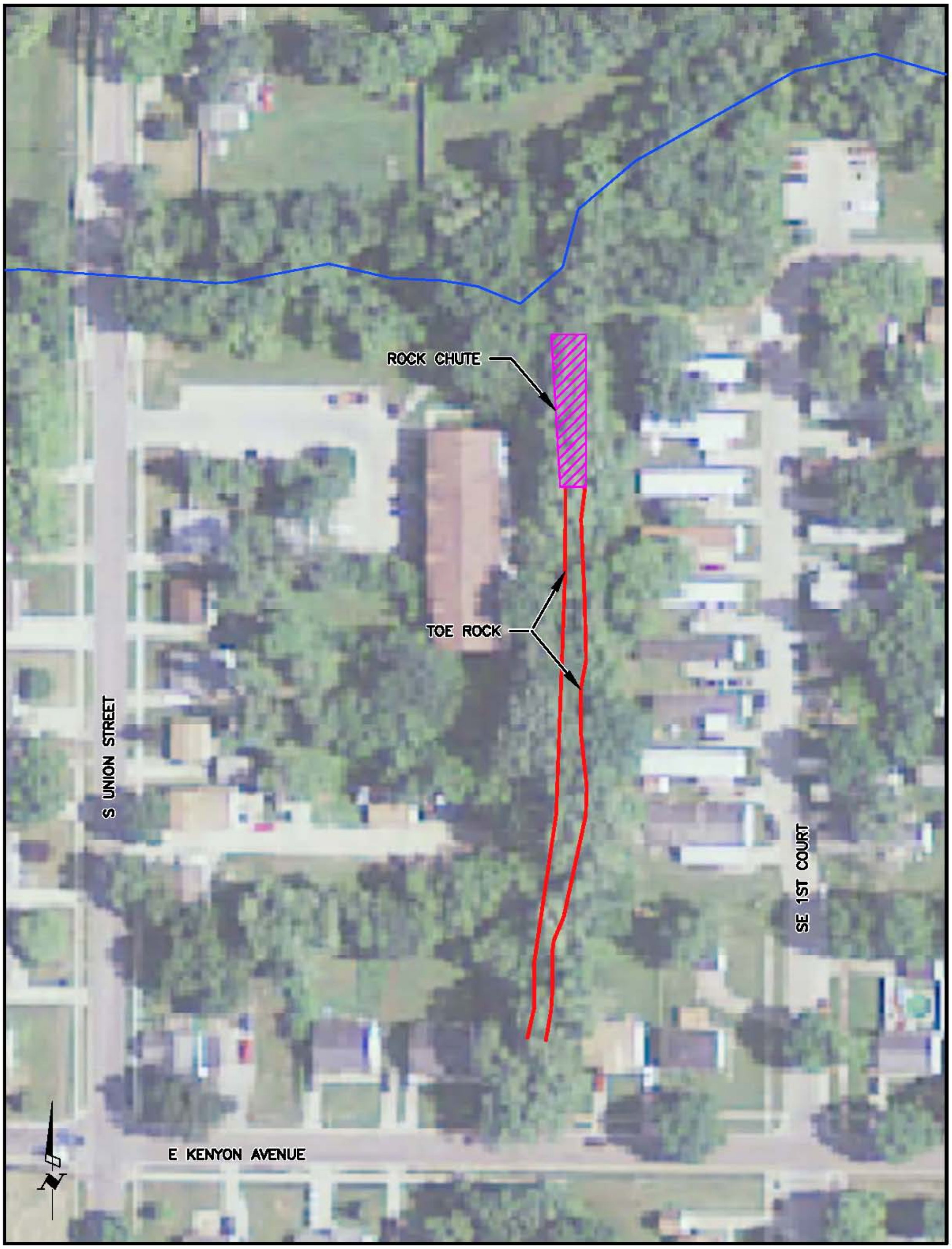


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Figure 7-21: YC-12: Main Branch near Southeast 1st Court and Southeast Porter Avenue

Project YC-13: Main Branch from Southwest 8th Street to South Union Street

This project is in the main branch of Yeader Creek as shown in Figure 7-22: Main Branch from Southwest 8th Street to South Union Street. The project area includes 3,200 feet of the south branch of Yeader Creek. The project includes a grade control structure, a repaired outfall, and toe rock to stabilize the creek. The grade control structure creates a shallow pool of water in the creek that will silt in over time. This protects the banks by reducing the channel slope, which reduces the water velocities to minimize erosion. The outfall shown is severely eroded and the flow out of the pipe is undercutting the bank. Repairing outfall prevents local erosion that contributes sediment to Easter Lake. The toe rock protects the creek from erosion by stabilizing the toe of the bank with rock rip rap. By creating a stable point at the toe of the bank creek flow is not allowed to undercut the bank.

Ownership:

The project area is on private property.

Site Selection:

This site was selected due to the stability of the banks and the high average annual sediment load the section of the stream produces. The stream stability and average sediment load were estimated as part of NRCS's August 2010 erosion and sediment delivery study.

Project Summary:

The project includes construction of three grade control structures, 2,200 linear feet of toe rock, and repair of an outfall. The grade control structures are is 2 to 3 feet tall berms with a 3:1 side slope on the upstream side and a 10:1 side slope on the downstream side. The grade control structures are reinforced with sheetpiling to ensure the structures are not displaced. The grade control structures are also covered with rock rip rap that is keyed in the creek floor to protect the structure from erosion. The grade control structure's impact on channel flow depth during large storm events should be evaluated as part of the final design.

Rock rip rap is utilized to stabilize the area downstream of the eroded outfall.

The toe rock is rock rip rap placed at the bank. The rip rap extends 3 feet vertically up the bank and is keyed into the channel to prevent undercutting. The rip rap follows the existing slope but should not be placed at a slope steeper than 1.5:1. If the bank slope is steeper than 1.5:1, the bank will need to be reshaped.

Maintenance:

The grade control structures, repaired outfall, and toe rock are recommended to be inspected annually and after large storm events to determine if the rock rip rap is in place for the first five years or until vegetation is well established. If the rock rip rap is displaced it is recommended to be replaced. After the vegetation is established and the upstream pools have begun to silt in, the structures will be very stable and little inspection or maintenance will be required.

Estimated Total Project Cost:

Item	Estimated Cost
Mobilization	$17,000
3 Grade Control Structures	$115,000
Toe Rock (2,200 LF)	$120,000
Outfall Repair	$10,000
Engineering	$60,000
Total	$295,000 - $345,000

Water Quality Benefits:

The primary purpose of the project is to reduce sediment loading to Easter Lake. The grade control structures will reduce the flow velocities and increase infiltration by pooling water upstream of the structures. The reduced flow velocities will protect the creek upstream of the structure from headcutting and streambank erosion; effectively reducing the sediment loading to Easter Lake. The toe rock stabilizes toe and protects the side slopes, reducing the sediment that is deposited in the creek. The toe rock stabilizes toe and protects the side slopes, reducing the sediment that is deposited in the creek. The outfall repair will stabilize the area downstream of the culvert under Kenyon Avenue. The reduction of sediment loading on Easter Lake for project YC-13 is shown in the table below. Reducing the sediment loading to Easter Lake will also reduce phosphorus loading by unpredictable quantity.

Annual Pollutant Load Reduction Estimates for YC-13

Pollutant	Current Pollutant Load to Easter Lake	Anticipated Annual Load Reduction	Percent Annual Reduction
TSS(sediment)	7,000 tons*	220 tons	3%
Phosphorus	4,250	20 pounds	<1%

* Annual reduction based on construction YC-13 with the remainder of the watershed in its current state. As projects and BMPs are completed in the watershed, the annual load will be reduced.

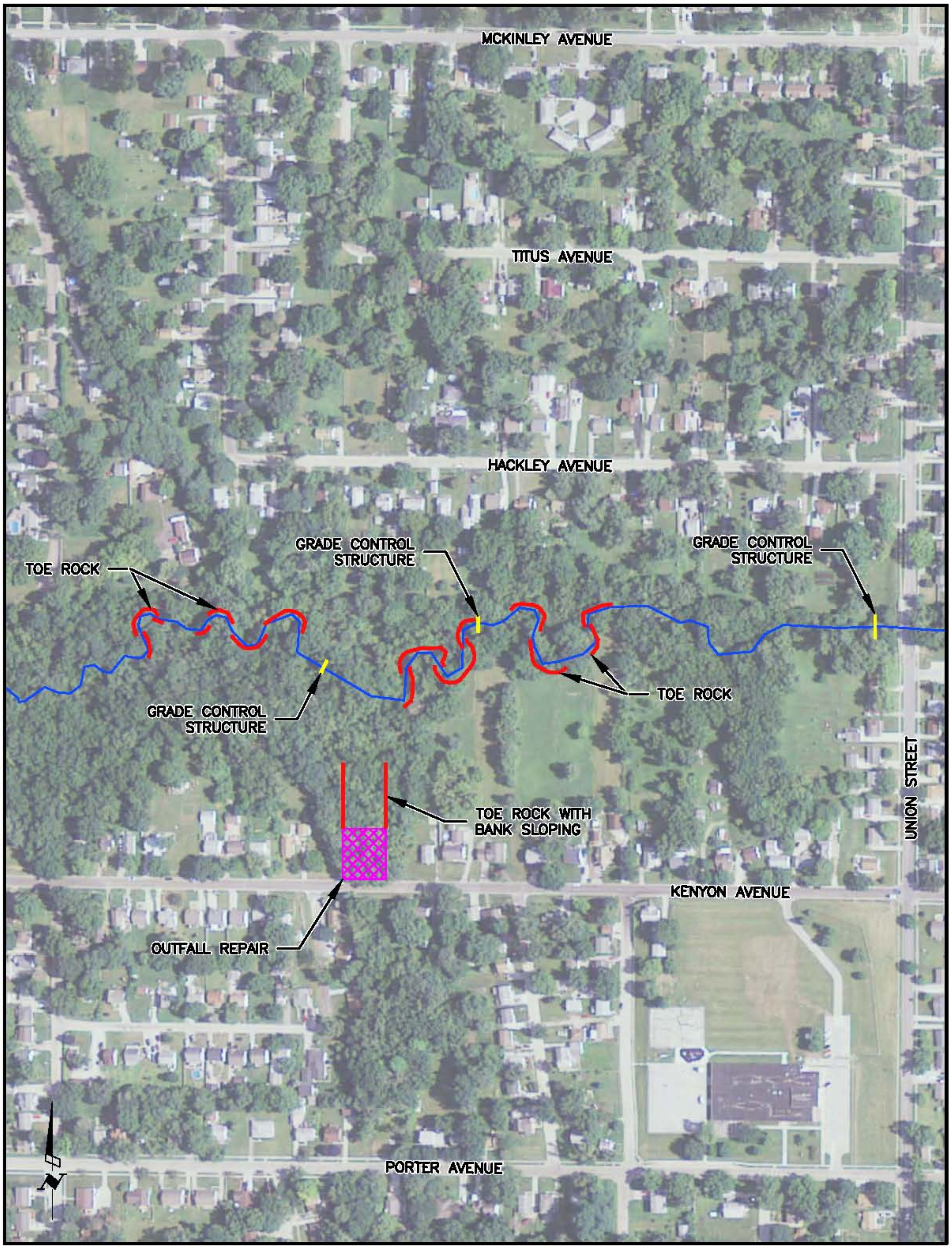


Figure 7-22: Main Branch from Southwest 8th Street to South Union Street

Project YC-14: Main Branch near Spring Street

This project is in the south branch of Yeader Creek as shown in Figure 7-23: YC-14 Main Branch near Spring Street. The project area includes 1,700 feet of the main branch of Yeader Creek. The project includes grade control structures, toe rock, and rock armored side slopes to stabilize the creek. The grade control structures create shallow pools of water in the creek that will silt in over time. This protects the banks by reducing the channel slope, which reduces the water velocities to minimize erosion. The toe rock protects the creek from erosion by stabilizing the toe of the bank with rock rip rap. By creating a stable point at the toe of the bank, creek flow is not allowed to undercut the bank. Areas of the creek that the side slopes are encroaching on Spring Street are armored with rip rap to the top of the bank to reduce erosion and protect Spring Street.

Ownership:

The project area contains both public and private property.

Site Selection:

This site was selected primarily based on its proximity of its banks to Spring Street and the public safety hazard that could be caused by erosion reaching the street. Stabilization of the banks will protect the street and reduce the average annual sediment load the section of the stream produces. The stream stability and average sediment load were determined as part of NRCS's August 2010 erosion and sediment delivery study.

Project Summary:

The project includes construction of three grade control structures, 2,600 linear feet of toe rock, and rock armored side slopes. The grade control structures are is 2 to 3 feet tall berms with a 3:1 side slope on the upstream side and a 10:1 side slope on the downstream side. The grade control structures are reinforced with sheetpiling, as shown on Figure 7-24: Structures 6, 11, and 12 YC-14, to ensure the structures are not displaced. The grade control structures are also covered with rock rip rap that is keyed in the creek floor to protect the structure from erosion as shown in in Figure 7-26: Typical Grade Control Structure YC-14. The grade control structures increase the flow depth in the channel during the 100 year event by an estimated 0.2 feet to 0.7 feet. The grade control structures' impacts should be further evaluated as part of their final design.

Sections of the creek that are encroaching on Spring Street are armored to the top of the bank with rip rap. The rip rap is keyed into the channel to prevent undercutting.

The toe rock is rock rip rap placed at the bank. The rip rap extends 3 feet vertically up the bank and is keyed into the channel to prevent undercutting. The rip rap follows the existing slope but should not be placed at a slope steeper than 1.5:1. If the bank slope is steeper than 1.5:1, the bank will need to be reshaped. Figures 7-24 through 7-28 detail design aspects of YC-14.

Maintenance:

The grade control structures, rock armor, and toe rock are recommended to be inspected annually and after large storm events to determine if the rock rip rap is in place for the first five years or until vegetation is well established. If the rock rip rap is displaced it is recommended to be replaced. After the vegetation is established and the upstream pools have begun to silt in, the structures will be very stable and little inspection or maintenance will be required.

Estimated Total Project Cost:

Item	Estimated Cost
Mobilization	$15,000
3 Grade Control Structures	$85,000
Toe Rock (2,600 LF)	$140,000
Rock Armor (2 Areas)	$70,000
Engineering	$75,000
Total	$360,000 - $410,000

Water Quality Benefits:

The project will reduce sediment loading to Easter Lake. The grade control structures will reduce the flow velocities and increase infiltration by pooling water upstream of the structures. The reduced flow velocities will protect the creek upstream of the structure from headcutting and streambank erosion; effectively reducing the sediment loading to Easter Lake. The toe rock stabilizes toe and protects the side slopes, reducing the sediment that is deposited in the creek. The rock armor protects the side slope, reducing the sediment that is deposited in the creek. The reduction of sediment loading on Easter Lake is shown in the table below. Reducing the sediment loading to Easter Lake will also reduce phosphorus loading by unpredictable quantity.

Annual Pollutant Load Reduction Estimates for YC-14

Pollutant	Current Pollutant Load to Easter Lake	Anticipated Annual Load Reduction	Percent Annual Reduction
TSS(sediment)	7,000 tons*	45 tons	<1%
Phosphorus	4,250	5 pounds	<1%

* Annual reduction based on construction YC-14 with the remainder of the watershed in its current state. As projects and BMPs are completed in the watershed, the annual load will be reduced.

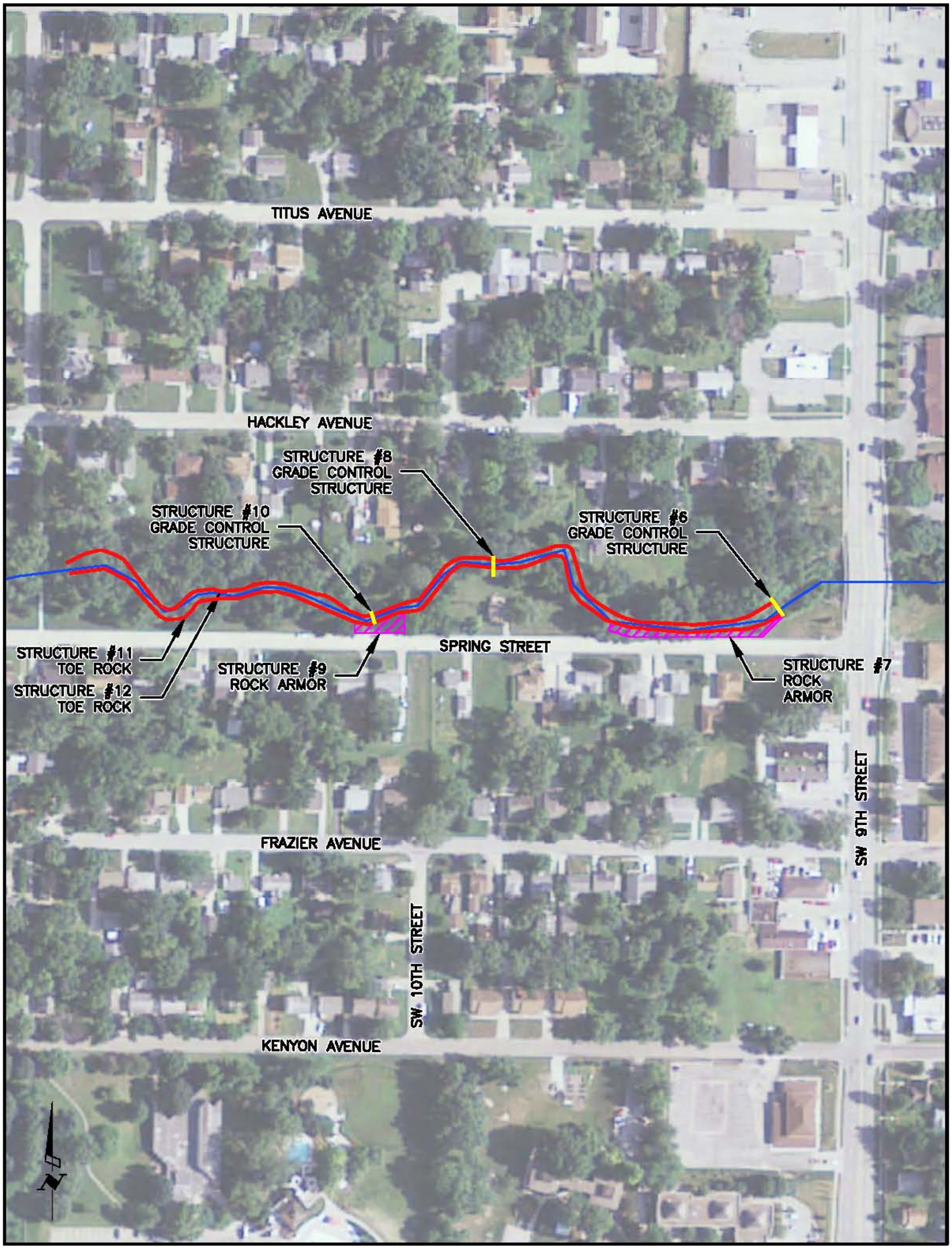


Figure 7-23: YC-14 Main Branch near Spring Street

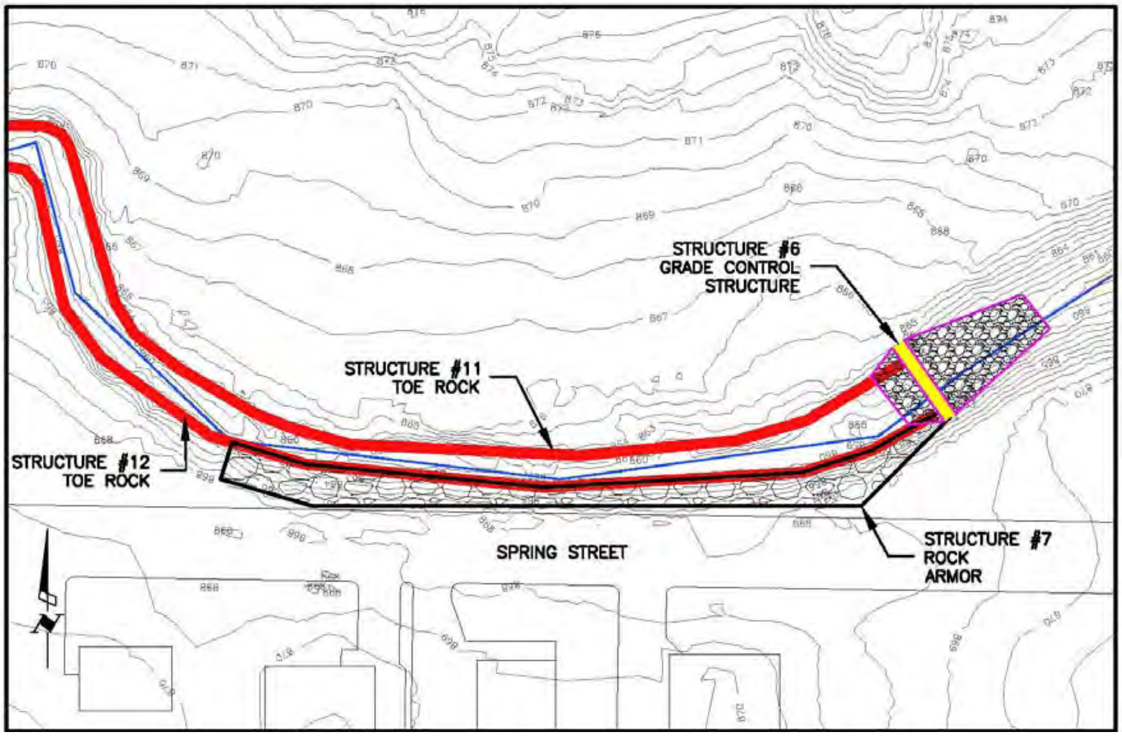


Figure 7-24: Structures 6, 11, and 12 YC-14

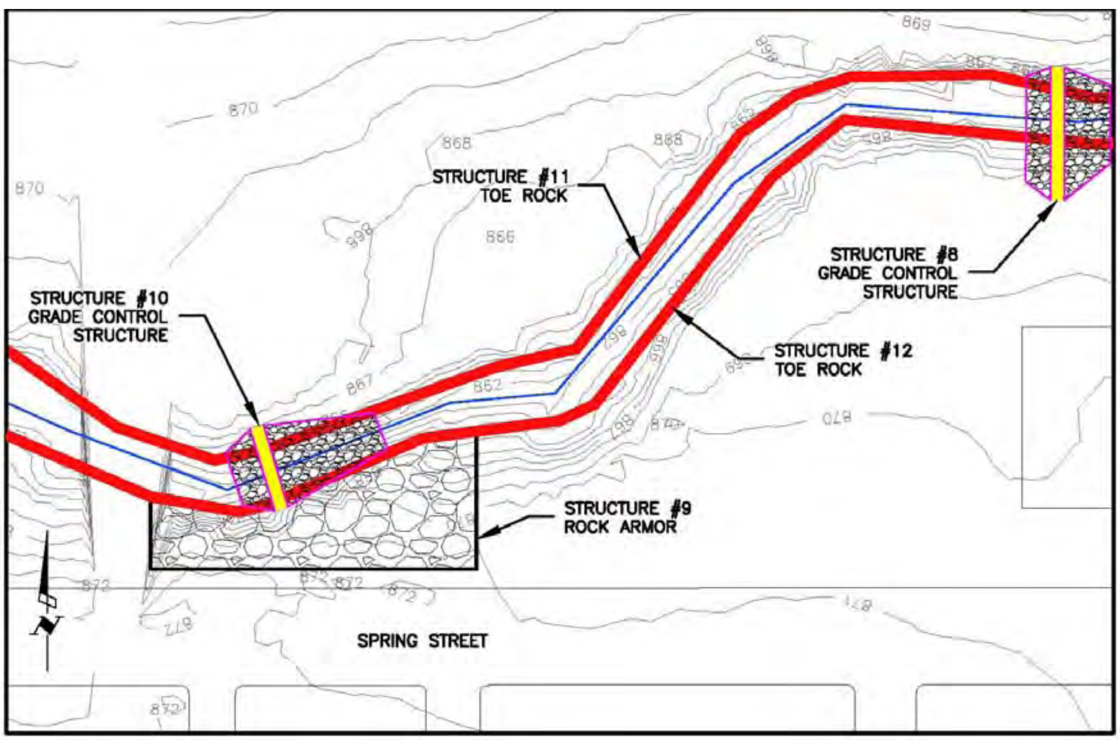


Figure 7-25: Structures 8-12 YC-14

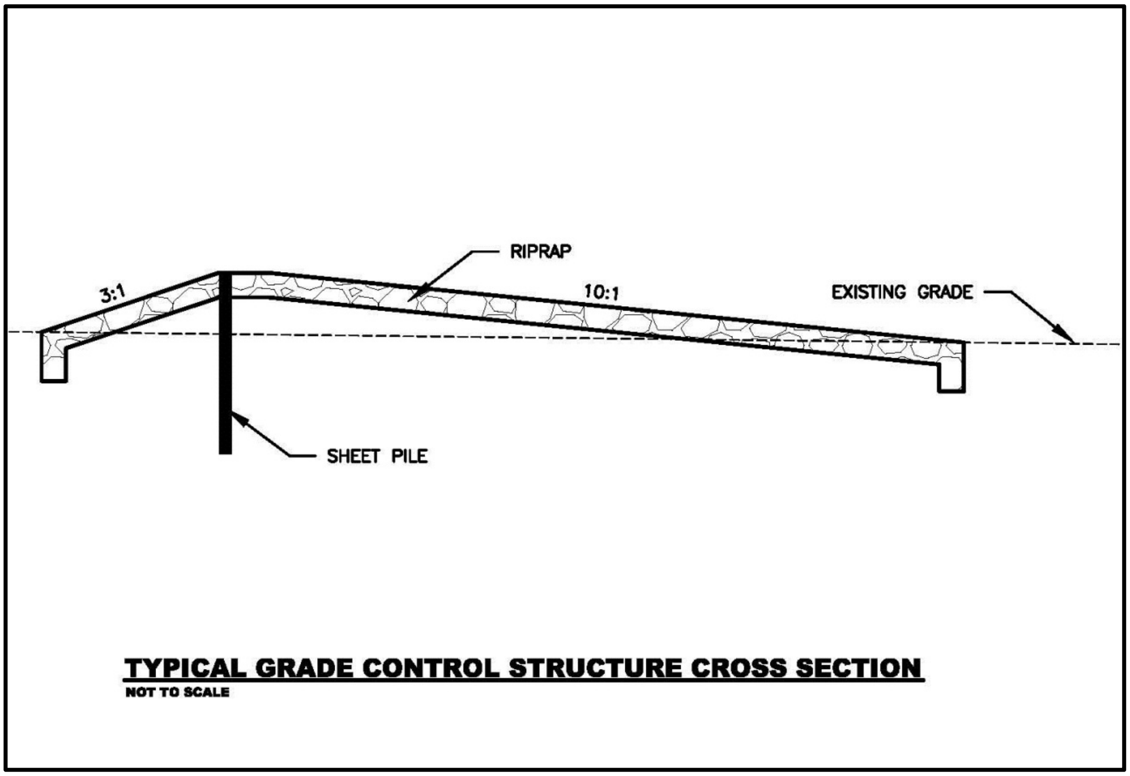


Figure 7-26: Typical Grade Control Structure YC-14

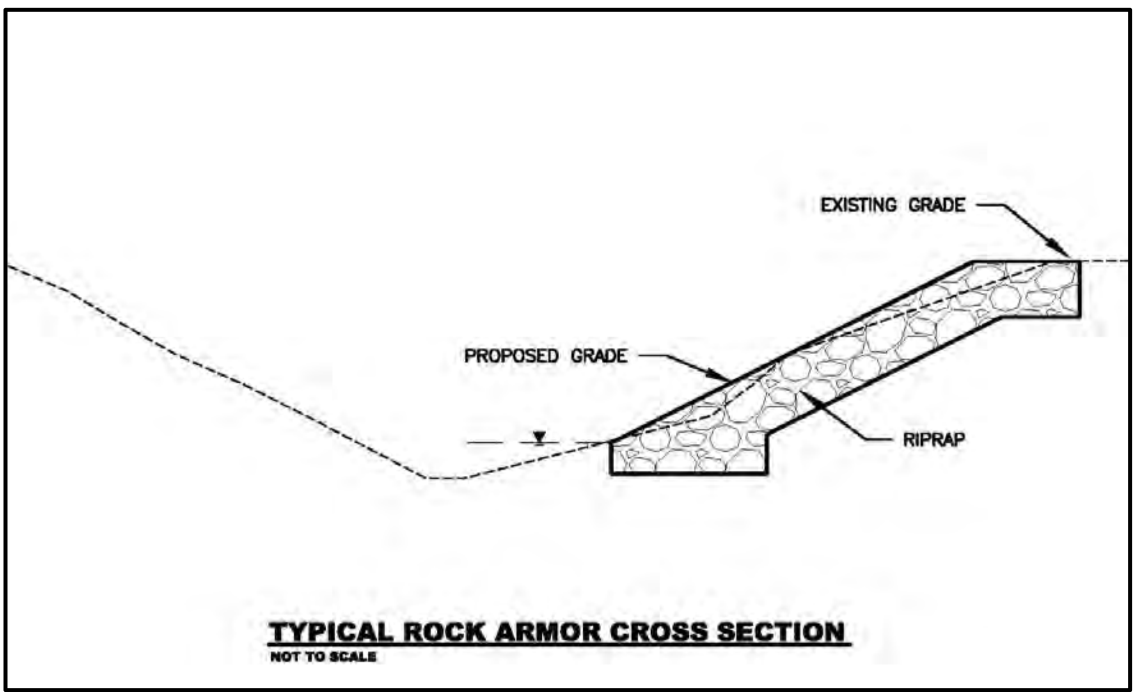


Figure 7-27: Typical Rock Armor Cross Section YC-14

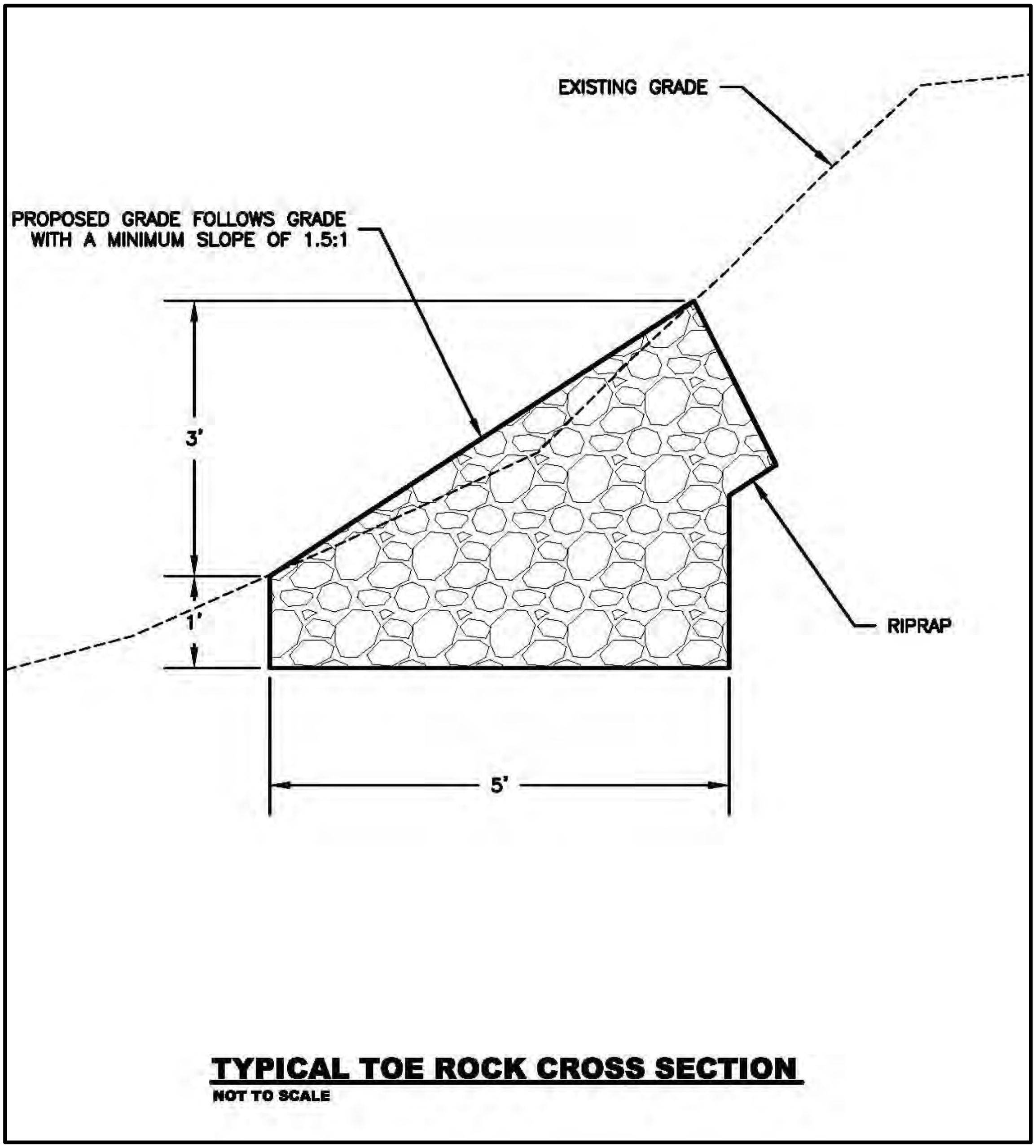


Figure 7-28: Typical Toe Rock Cross Section YC-14

7.12. Watershed Projects Descriptions

During field screening for watershed projects, three specific project locations were identified including WS-15 (Ewing Park Bioswales), WS-4 (Detention Structure Dredging), and WS-6 (Detention Structure Construction). An additional site was identified at the South Side Library but is not detailed in this plan. This potential project included a parking lot drainage disconnect to a bio-infiltration area (south of the entrance) and a grass swale north of the main building. Throughout Phase One implementation additional site specific watershed project locations will be identified using practices outlined in this Plan as described in Section 6 – Management Practices.

Utilizing the Rainscaping Iowa practices, siting and construction of residential water quality projects will be ongoing during the life of the plan. Small scale residential BMPs, such as rain gardens, have not been identified due to the unknown acceptance of these programs by residents and property owners. General recommendations for each Rainscaping Iowa practice that is most relevant to this Plan have been identified in Table 7-10: Urban BMP Recommendations.

Table 7-10: Urban BMP Recommendations

Practice	Installation Goal	Priority Location	Notes
Bioretention Cells	2/year – 20 total	Larger scale – parking lots, commercial/industrial	Consider retrofitting of existing dry detention cells to bioretention cells
Bioswales	4,000 feet total	Roadside drainage areas	
Green Roofs	2 total	N/A	
Native Landscaping	All BMP projects	Public-use areas	
Native Turf	10,000 square feet/year	Public-use areas, South Side Library, Parks	Use as demonstration sites
Permeable Pavement Systems		• Public-use areas • Commercial areas (incentives) • New parking lots / resurfacing parking lots	Use as demonstration sites
Rain Gardens	10/year – 100 total	Basin-wide	
Rainwater Harvesting (Rain Barrels)	20/year – 200 total	Residential basin-wide	
Soil Quality Restoration	25 lawns/year	Southeast Subbasin	
Stream Corridor/Shoreline Stabilization	250 feet/year – 2,500 feet total	Three Lakes Estates	
Downspout Redirection	150/year	Residential/commercial basin wide	
Waste Containers	10/year – 100 total	Parks	
Honeysuckle Treatment	75 acres/year	Treed areas surrounding Easter Lake and tributaries	

Project WS-4: Detention Structure Dredging

The project is located in Easter Lake's southeast watershed. The project includes dredging of eight detention structures as shown previously in Figure 5-3: Southeast Detention Basins.

Ownership:

The project is on public property.

Site Selection:

N/A

Project Summary:

The project includes mechanically dredging eight detention structures to remove sediment and restore their original storage volumes. The structures include Detention Structures 1, 3, 4, 5, 8, 9, 9a, and 10.

Maintenance:

Removing sediment in the detention structures as needed is recommended.

Estimated Total Project Cost: $375,000 - $400,000

Water Quality Benefits:

Increasing the depth of the detention structures will increase phosphorus removal efficiencies. Removing sediment from the detentions structures will also reduce sediment loading on Easter Lake by reducing sediment re-suspension in the detention structures. The current contribution of sediment from re-suspension in the detention structures is unknown and therefore a sediment reduction from dredging the structures is not included.

Annual Pollutant Load Reduction Estimates for WS-4

Pollutant	Current Pollutant Load to Easter Lake	Anticipated Annual Load Reduction	Percent Annual Reduction
Phosphorus	4,250	235 pounds*	6%

*Anticipated phosphorus reduction based on ISU 2011 Diagnostic/Feasibility Study

Project WS-6: Detention Structure Construction

The project is located in Easter Lake's southeast watershed. The project includes completing of the 1994 Southeast Annex Area Comprehensive Storm Water Study and Master Plan by construction three detention structures as shown previously in Figure 5-3: Southeast Detention Basins.

Ownership:

The project is on public property.

Site Selection:

The sites were selected as part of the 1994 Southeast Annex Area Comprehensive Storm Water Study and Master Plan

Project Summary:

The project includes constructing three detention structures to complete the 1994 Southeast Annex Area Comprehensive Storm Water Study and Master Plan. The structures include Detention Structures 2, 6, and 7. The Plan should be reviewed to determine the final locations of the detention structures.

Maintenance:

Removing sediment in the detention structures as needed is recommended.

Estimated Total Project Cost: $4,450,000 (The costing of this project is from the 1994 Southeast Annex Area Comprehensive Storm Water Study and Master Plan. The cost estimates should be re-evaluated using more current costing)

Water Quality Benefits:

Detention structures provide a location for sediment to be deposited before it enters Easter Lake. The structures also effectively remove phosphorus if adequate water depths are maintained in the structures.

Project WS-15: Ewing Park Bioswales

This project treats runoff from three separate parking lots located in Ewing Park as shown in Figure 7-29: Ewing Park Bioswales

Ownership:

The project area contains public property.

Site Selection:

This site was selected due to its proximity to Yeader Creek and Easter Lake. It also is an excellent location for public education regarding water quality features for impervious areas.

Project Summary:

The project includes water quality features for three parking lots, Parking Lot #1, Parking Lot #2, and Parking Lot #3. Parking Lot #1 is treated with a bioswale. Parking Lot #2 is treated with a bioswale, a rain garden, and a native grass swale. Parking Lot #3 is treated with a bioswale and a native grass swale.

Maintenance:

The grade control structures, the toe rock, and the rock armor are recommended to be periodically inspected to determine if the rock rip rap is in place. If the rock rip rap is displaced it is recommended to be replaced.

Estimated Total Project Cost: $135,000 - $165,000

Water Quality Benefits:

The parking lots quickly move stormwater off the parking lots and into the creek. The runoff contains pollutants from the materials used to construct the parking lots and from automobiles in the parking lot. The parking lot runoff also coveys sediment to the creek and contributes to thermal pollution. The bioswales, the rain garden, and the native grass swale slow down the runoff flowing off of the parking lots and allow it to be naturally treated by infiltration. This effectively reduces the pollutant load entering the creek. The reduction in pollutant loading on Easter Lake is for the Ewing Park bioswales is shown in the table below.

Annual Pollutant Load Reduction Estimates for YC-WS15

Pollutant	Current Pollutant Load to Easter Lake	Anticipated Annual Load Reduction	Percent Annual Reduction
Phosphorus	4,250	5 pounds	<1%

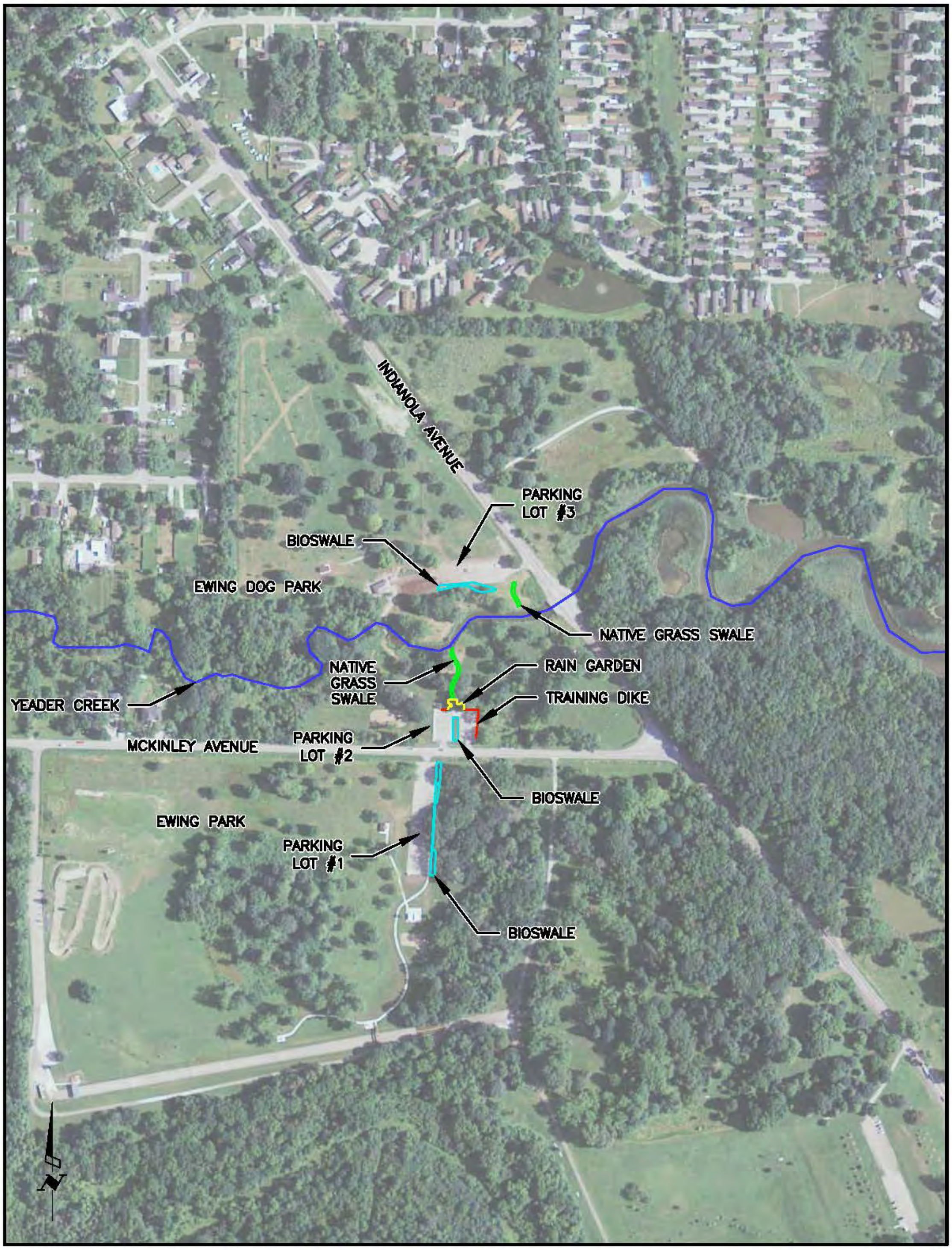


Figure 7-29: Ewing Park Bioswales

SECTION 8 - MONITORING

8.1. Introduction

One of the most important aspects of any management plan is to assess and document water quality improvements in the watershed. The closer that monitoring is brought to restoration areas where substantial improvements to water quality and biota are expected, the more likely water quality improvements will be documented. Due to the primary water quality goals and objectives pertaining to Easter Lake, the focus of monitoring will be on the in-lake conditions, with a smaller portion of the monitoring of water quality within the watershed.

According to the 2005 TMDL for Easter Lake, a monitoring plan will be used to determine if prescribed load reductions result in attainment of water quality standards and whether or not the target values are sufficient to meet designated uses. Monitoring activities may include routine sampling and analysis, biological assessment, fisheries studies, and watershed and/or water body modeling. Monitoring is essential to all TMDLs in order to:

- Assess the future beneficial use status;
- Determine if the water quality is improving, degrading or remaining status quo;
- Evaluate the effectiveness of implemented best management practices.

Monitoring activities will require a comprehensive methodology to ensure progress towards improving water quality can be measured for all types of water quality projects and programs listed in this Plan. This includes a strategy for measuring each of the following:

- In-lake improvements
- Yeader Creek improvements
- Watershed projects and programs

Each component will require a differing method for monitoring progress for each component of the watershed targeted for water quality improvements. Monitoring and evaluation of projects and programs may be required as a stipulation for receiving funding assistance.

Once restoration work has been completed in the lake and its watershed, a monitoring program with the following elements should be implemented to determine conditions in the lake as well as in the tributaries. The post restoration monitoring plan should include lake water monitoring for at least two years, tributary monitoring, and watershed monitoring.

8.2. Monitoring Overview

Monitoring in the future will serve two primary purposes: to facilitate the implementation of water quality alternatives and the second is to document progress in meeting project goals and objectives.

Specific monitoring maybe required in order to get state and federal approval to implement some measures and will be defined in the preliminary design phase of projects. This will include ‘pre-treatment’ and ‘post-treatment’ monitoring of specific locations in the watershed, such as the Yeader Creek improvement projects.

Routine monitoring will be important in tracking water quality conditions during and after the project. The response in water quality to in-lake and watershed treatments are not well documented in available literature, a long-term monitoring program will be required to evaluate the progress in meeting the water quality goals and objectives identified in this plan. The biological communities and chemical constituents may take several years after project completion to reach stability (Carter Lake 2008). Routine monitoring will be focused on the three primary in-flows to Eater Lake from the Main South Branches of Yeader Creek and the ‘south-arm’.

Since the focus of this plan is on Easter Lake, monitoring will be focused on Easter Lake. Routine monitoring activities will encompass a combination of physical, chemical, and biological elements. Specific monitoring approaches will be designed annually through a coordinated effort among several agencies. All monitoring activities will follow existing protocols established by respective agencies and will be documented in an annual monitoring plan.

Information provided from the monitoring activities will be distributed to the project stakeholders. The monitoring results will be used, as appropriate, to revise the monitoring strategies, implementation strategies, and/or the project goals and objectives.

The following sections describe monitoring for Easter Lake, Yeader Creek, and the watershed.

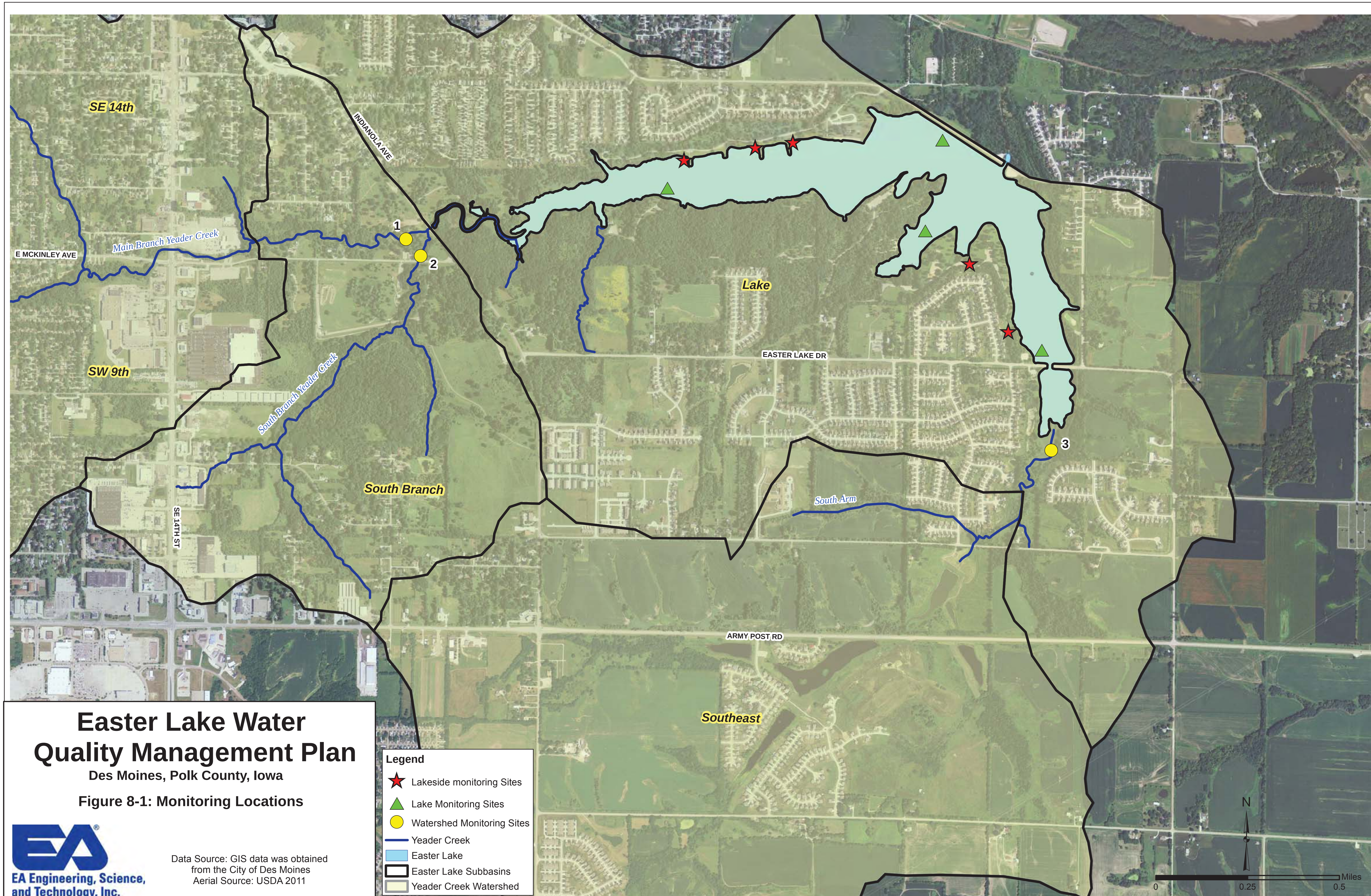
8.3. Post Restoration Lake Monitoring

The following methodology for in-lake monitoring was adapted from the Easter Lake Diagnostic Feasibility Study established by ISU in 2011.

A sampling station would be established at the deepest point in the lake. For a two year period, samples would be taken monthly from September through April and biweekly from May through August at each meter of depth from the surface down to 0.5 m from the bottom. In addition to these sampling depths, a mixed zone water sample would be collected using a 0-2 m column sampler. Samples would be collected between 0800 and 1700 hours. All samples would be analyzed for total and soluble reactive phosphorus; nitrite plus nitrate nitrogen, ammonium, unionized ammonia, and total nitrogen; total suspended solids; pH; alkalinity; and carbon. Samples collected from the upper mixing zone would be analyzed for chlorophyll a. Phytoplankton and zooplankton biomass in the upper mixed zone would be determined through taxonomic identification, cell counts, and cell volumes, and reported in terms of biomass of each taxonomic level identified. Secchi disk transparency and suspended solids would also be determined at each sampling period. During the swimming season (April – September), samples would be collected for determinations of total coliform and *E. coli* bacteria and microcystin concentrations. Table 8-1: In-lake Water Quality Parameters below list specific evaluative criteria to be used for in-lake monitoring.

Water samples would be taken from the nine established tributary sites on the same days that the lake is sampled (when they are flowing) for analyses of total and soluble reactive phosphorus; nitrite plus nitrate nitrogen, ammonium, unionized ammonia, and total nitrogen; total suspended solids; pH; and alkalinity. In addition, samples would be analyzed for total coliform and *E. coli* bacteria concentrations.

Lake mapping (bathymetry) is recommended to be complete at the conclusion of Phase 2 in order to fully understand the capacity of the lake after sediment removal. Updating the lake map every 5 years will allow for an understanding of how BMPs are reducing sediment loads into Easter Lake.



Easter Lake Water Quality Management Plan

Des Moines, Polk County, Iowa

Figure 8-1: Monitoring Locations

EA Engineering, Science, and Technology, Inc.

Data Source: GIS data was obtained from the City of Des Moines
Aerial Source: USDA 2011

Table 8-1: In-lake Water Quality Parameters

Water Quality Parameter	Importance
Total Phosphorus	The nutrient that most often leads to excess algae growth, oxygen depletion, Cyanobacteria blooms, and other water quality problems. It is used to indicate fertilizer and sewage inputs and is the nutrient that is most important to lake management models.
Soluble Reactive Phosphorus (PO_4)	Soluble reactive phosphorus is an analytical form of phosphorus (sometimes called "phosphate") that is soluble and is thought to be a fraction that is readily available for uptake by aquatic organisms. Lake management models rely on estimates of ratios of this to total phosphorus for determining the potential for biological removal of excess nutrients.
Nitrogen:(TK N, NO_3, NH_X)	Indicates fertilizer and sewage inputs; important in understanding nutrient limitation of aquatic organisms.
Solids (TSS, ISS, VSS)	Total suspended solids (TSS) are the soil, silt, and biological particles suspended in the water; useful in assessing watershed contributions of silt, ecosystem productivity, and sediment re-suspension. ISS are the inorganic particles suspended in water that are usually of geological origin; useful in assessing watershed contributions of geological materials including surface and sub-surface soils. VSS are the organic particles suspended in water that are usually of biological origin; useful in assessing watershed contributions of crop natural plant residues, sewage, and organic soils, as well as ecosystem productivity, and sediment re-suspension.
Chlorophyll a	A measurement of photosynthetic pigment used to estimate phytoplankton biomass
pH & Alkalinity	pH is the inverse concentration of hydrogen ions in water. Low pH (<7) waters are acidic while high pH (>7) waters are basic. pH measurements assess acidification status, the presence of decompositional environments and high pH (>9.5) indicates extreme algae bloom environments. pH is used with alkalinity to determine carbon available to plants. Alkalinity is the buffering capacity of waters, usually derived from dissolved carbonates of calcium and magnesium. Alkalinity determines the inorganic carbon availability in water and (with pH) determines the dissolved carbon dioxide available for plant growth.
Conductivity	Indicator of the amount of ions and salts dissolved in water; used to detect decomposition, contamination by salts, and to estimate ionic strength of waters; important in detection of pollution and understanding carbon limitation by plankton.
Carbon (Dissolved Organic Carbon)	Organic matter in solution that usually results from the dissolution of plant and animal matter within lakes or in lake watersheds; DOC is useful in understanding watershed process, light penetration, and can result in highly toxic compounds after water treatment.
Turbidity	The back-scattering of light by particles suspended in the water; used to assess and establish goals of recreational use and ecosystem health.
Dissolved Oxygen	Indicates the concentration of dissolved oxygen in the water. Aquatic life (fish and fish-food organisms) can be stressed with bottom oxygen concentrations less than 5 mg/L and may die at less than 2 mg/l.
Secchi Disk Transparency	Secchi depth is used to determine water transparency. Clarity is affected by algae as well as suspended materials in the water and water color. Secchi disk depth is often used as an indicator of overall algal abundance and general lake productivity.
Plankton: Phytoplankton Zooplankton	Zooplankton and phytoplankton are a primary food source for other organisms. They respond quickly to environmental changes and species assemblages of both are useful in assessing water quality. An overabundance of phytoplankton increases turbidity, degrades recreational appeal, and can create toxins that are harmful to warm-blooded animals.
E. coli	*E coli* is a type of coliform bacteria found in the intestinal tract of warm-blooded animals. Indicates human or animal waste.
Total Coliforms	Coliform bacteria indicate the presence of all coliform group bacteria, both vegetative and fecal in origin, and are used as a tracer for human contamination.
Microcystin	Microcystis are a type of cyanobacterium common in eutrophic lakes and reservoirs. They are known to produce cyanobacterial hepatotoxins called microcystins, can be harmful to human and animal health, and can be lethal to many kinds of aquatic and terrestrial organisms.

Source: ISU DF Study 2011

8.4. In-stream Monitoring

Watershed monitoring locations will include three sites to be sampled throughout plan implementation and site specific locations to monitor the effectiveness of individual watershed projects. Due to the potential of project locations to change during planning and design, monitoring locations may also change. For purposes of this plan routine monitoring locations have been identified and displayed in Figure 8-1: Monitoring Locations.

8.4.1. Routine Monitoring

Routine monitoring of watershed improvements will be completed thought monitoring three in-stream locations at the confluence of the Main and South Branches of Yeader Creek with Easter Lake, and the confluence of the 'south-arm' with Easter Lake. This will allow for a long-term analysis of changes in water quality throughout the entire watershed over time. Parameters to be evaluated include the following:

- Total Phosphorus
- Total Nitrogen
- Solids (TSS, ISS, and VSS)
- Physical parameters – temperature, pH, conductivity, turbidity, dissolved oxygen
- *E. coli*
- Dissolved Organic Carbon

Routine monitoring should begin in 2013 and occur quarterly throughout the end of phase three in 2021.

8.4.2. Specific Monitoring

Specific monitoring is intended to show changes in water quality after construction on watershed projects, including stream restoration projects. These locations have not been specified but will be above the stream restoration project, (pre-treatment location), and below the stream restoration project, (post-treatment location). Specific monitoring is recommended to occur as projects are constructed on a quarterly basis for one year after the completion of construction. Parameters to be evaluated are the same as identified above in Section 8.4.1.

8.4.3. Visual Assessment Monitoring

Yeader Creek and its tributaries are currently an ever changing and dynamic natural system. High-flow events can have a dramatic effect on the characteristics of the channel, tributaries, and potentially damage existing infrastructure. Channel erosion can threaten structures, property, infrastructure, streams, and other natural resources. Channel erosion can also impact water quality through the transportation of sediment. Due to the dynamic nature of the creek, the stream stability and erosion threat will be continuously identified through visual observation.

During years of low flow, annual or bi-annual inspections of new projects will be necessary to ensure each project is stable and performing as designed. During seasons of high-flow, visual inspections will be conducted after water levels recede to a safe level. The following items should be noted during visual observations:

- Stream stability – use of pictures, measurements, and records to indicate stream stability progress.
- Bank stability – the stability of stream banks should be recorded above and below project sites. Records will be kept on visual observations of increased stability.
- Vegetation establishment – visual observation of vegetation establishment. Regular monitoring and maintenance in areas where native vegetation was seeded or drilled.

- Maintenance inspections – records of necessary maintenance or modifications of grade control structures, toe rock, and project other features to mitigate damages to new structures.

The City of Des Moines will be responsible for keeping monitoring records of Yeader Creek project sites. Records should be made available to other project sponsors and used to show progress towards water quality improvements and sedimentation reductions to Easter Lake.

8.4.4. Social Behavior Monitoring

Additional monitoring can be completed though tracking how people respond to available programs, incentives, and cost-share made available in this plan. The basis for identifying progress towards program and project success will be measured through several evaluation criteria. Criteria have been split into short term and long term, and include evaluation of structural and programmatic BMPs. The evaluation criteria include data collection through water quality monitoring and record keeping as well as gathering information from property owners and residents.

It is important to gather information from property owners and residents across the entire watershed, with an emphasis on monitoring the progress of all projects, including educational and programmatic, especially those implemented of the Phase One period. This could be completed through online and phone surveys, request for information to be submitted to a website, and information gathered at neighborhood association meetings. Information gathered on the effectiveness and progress of Phase One projects can be used to make modifications and improvements for future phases.

Over the long-term, information will be collected on how property owners change their everyday habits to improve the health of their watershed (i.e. switching to no-phosphorus fertilizers, picking up pet waste). This information can be collected in a similar fashion.

While it is difficult to directly track if information and education efforts are actually making a reduction in Total Phosphorus in Easter Lake, it is important to track known quantifiable actions such as the number of no-phosphorus fertilizer bags used as giveaways, number of coupons for no-phosphorus fertilizers, etc. This information is useful in showing the success of programmatic BMPs.

To evaluate progress of structural BMPs, project sponsors will keep records of each improvement, the water quality benefits, and other details such as how well native vegetation was established, how well the BMP appeared to be functioning, and pictures of each BMP.

A separate website specific to implementation of the Basin Plan is recommended. Creating an opportunity to view ongoing implementation of projects will allow the public to provide feedback, learn about the benefits of stormwater BMPs, and know what is being planned in the future. This website could also feature an inventory of existing stormwater BMPs in watershed, how many rain gardens or rain barrels have been installed, allow residents to post pictures of their projects, and quantify the number of improvements made by residents and property owners (i.e., number of disconnections, rain gardens, rain barrels, etc.).

SECTION 9 - TECHNICAL AND FINANCIAL RESOURCES

9.1. Introduction

It will be important to have knowledge of available financial resources as agencies take action to implement projects within this Plan. While the list below is a comprehensive summary of funding currently available it will be important to continuously research and add to this list over the life of the Plan. In addition, direct sources of funding from stakeholders such as the City of Des Moines and Polk County will need to be considered. Multi-agency coordination will greatly benefit and expedite funding opportunities. Below in Table 9-1: Financial Resources is a comprehensive listing of financial resources to be considered.

Table 9-1: Financial Resources

Administering Entity	Program Name	Program Description
IDALS/DSC www.iowaagriculture.gov	Soil and Water Enhancement Account (REAP & WPF)	REAP funds for water quality improvement projects and wildlife habitat & forestry practices; 50- 75% cost-share; Used as state match for EPA 319 funding
	Local Water Protection State Revolving Loans (SRF)	Low interest loans provided by SWCDs to landowners for permanent water quality improvement practices; subset of DNR program
	Watershed Improvement Fund	Local watershed improvement grants to enhance water quality for its beneficial uses including economic development.
	Watershed Improvement Review Board (WIRB)	Provides funding for multiple water quality improvement and flood prevention projects.
USDA/NRCS www.ia.nrcs.usda.gov	Wildlife Habitat Incentives Program (WHIP)	Cost-share contracts to develop wildlife habitat
	Cooperative Conservation Partnership Initiative (CCPI)	Conservation partnerships that focus technical and financial resources on conservation priorities in watersheds and airsheds of special significance
	Iowa Conservation and Partnerships: "Supersheds" Program	Cooperative effort among conservation agencies and organizations to combine resources to implement resource improvement projects
	Public Law 83-566	Contains authority to improve water quality as well as control flooding, reduce soil erosion, provide recreation, and provide a water supply
	Public Law 78-534	Permanent practices built for the purpose of erosion and flood control.
	Conservation Innovation Grants (CIG)	Nationwide grants for innovative solutions to a variety of environmental challenges
ACOE www.mvr.**usace**.army.mil/	Aquatic Ecosystem Restoration - Section 206	Restoration projects in aquatic ecosystems such as rivers, lakes and wetlands
Administering Entity	**Program Name**	**Program Description**

EPA www.epa.gov	Section 319 Clean Water Act	Source of low-cost financing for farmers and landowners, livestock producers, community groups, developers, watershed organizations, and others
	Targeted Watershed Grants	Nationwide grants for implementation of activities and BMPs specifically designed to improve water quality
	Water Quality Cooperative Agreements [Section 104(b)(3)]	Developing, implement, and demonstrate innovative approaches relating to the causes, effects, extent, prevention, reduction, and elimination of water pollution
IDNR/IFA	State Revolving Fund (SRF)	Provides low interest loans to municipalities for waste water and water supply; expanding to private onsite wastewater treatment systems, livestock, storm water, and NPS pollutants
IDNR/DSC	Stream bank Stabilization & Habitat Improvement	Penalties from fish kills used for environmental improvement on streams impacted by the kill
IDNR http://www.iowadnr.gov/	Watershed Improvement Grants (Section 319)	Allow groups such as Soil and Water Conservation Districts and other organizations to create watershed projects to improve the quality of water entering rivers, streams, and lakes.
	Water Monitoring and Assessment Program	Information available concerning water quality in lakes, streams, and wetlands
	IOWATER	Training, supplies, and technical support for citizen water quality monitoring network; subset of ambient program
	Lake Restoration Fund	Provides funding for restoration of Iowa's publicly owned lakes, in combination with watershed improvement to improve water quality.
	Resource Enhancement and Protection Program (REAP)	Provides funding for enhancement and protection of State's natural and cultural resources
	GIS mapping data for watershed managers	Watershed Atlas provides a variety of interactive GIS data layers for watershed planning on all watersheds in Iowa
	Ambient Water Quality Monitoring Network	Delivers consistent, unbiased information about the condition of Iowa's surface and groundwater resources
	Conservation Reserve Enhancement Program (CREP II)	To maintain and improve the water quality of priority lakes and cold water streams in Iowa

Source: Carter Lake Water Quality Management Plan, 2008

9.2. Technical Resources

Implementation of the management strategies and recommendations in the Plan will be a primary responsibility of the three primary stakeholders: IDNR, City of Des Moines, and PCCB. Several other stakeholders are involved and will be a continued part of the Technical Advisory Team that was put into place during establishment of the Plan. The TAT will stay in place and have a continued role in the implementation of the Plan over the next 10-year period. Below is a summary of each technical resource and key stakeholder available to assist with project and program implementation, monitoring, and evaluation of the Plan.

- **Iowa Department of Natural Resources –** Sponsor of projects, assistance with program implementation, lead agency for lake restoration activities and fishery renovation, and primary funding source, assist with plan monitoring and evaluation.
- **City of Des Moines Public Works –** Sponsor of projects, assistance with program implementation, primary funding source, grant sponsor, assist with education and outreach, assist with plan monitoring and evaluation.
- **Polk County Conservation Board –** Sponsor of projects, coordination of trail expansion with lake projects, grant sponsor, and assist with education and outreach.
- **Polk Soil and Water Conservation District -** Sponsor of projects, lead on urban water quality programs, urban conservation, education and outreach, grant sponsor.
- **Iowa Department of Agriculture and Land Stewardship –** Funding source, assistance with project implementation, agricultural BMPs, technical resource.
- **Iowa State University –** Assistance with water quality monitoring, evaluation, primary technical resource, data collection.
- **Natural Resources Conservation Service –** Funding source, engineering technical assistance, stream assessments.
- **Local Stakeholders / Property Owners / Citizens –** Continued participating in an implementation committee, public input, implementation of urban BMPs, outreach and education participation.