February
2024

Walker Pond Improvements

Latest news and bulletin updates

Walker Pond Treatments

Implemented in multiple stages, the Walker Pond Improvements Project has successfully incorporated diverse watershed-based management methods to improve the quality of runoff entering the existing pond. Notable initiatives include:

- Extending the Walker Lane Sewer
- Installing a vegetated filter strip (accompanied by a subsurface infiltration system)
- Introducing public education signage and communication efforts

These measures have specifically targeted the accumulation of phosphorus from the surrounding watershed, which contributes to heightened nutrient levels, excessive plant growth, and low dissolved oxygen—resulting in an unhealthy imbalance in water quality. The implemented strategies play a crucial role in mitigating potential stormwater pollutant loads, underscoring their importance in supporting the forthcoming treatment phase's effectiveness.

Examination of potential strategies within the pond (internal) and those implemented in the surrounding watershed (external) was conducted to develop a five-year Pond Management Plan. This plan is intended to serve as a guiding framework for ongoing maintenance efforts for continual promotion of healthier water quality. Evaluations included:

- Existing dense vegetation
- Elevated nutrient levels
- Sediment near pond
- Control of vegetation
- Reducing and eliminating invasive species
- Sustainable treatment regimen
- Diminished dissolved oxygen levels

The improvements, assessment and subsequent plan is vital to perpetuating continuous, safe, and balanced water quality and healthy aquatic life. In addition to the treatments, construction of the outlet control structure is proposed as part of this phase. The structure is designed to:

- Maintain pond elevations/ Town determined adjustments, as
- Control discharge flow (i.e. capacity of the downstream
- Comply with flood design standards (100-yr storm event)
- Public safety improvements
- Allow for water quality sampling activities
- Longevity, operations and maintenance ease,

To proceed with the upcoming project phase, obtaining approval from the Conservation Commission is necessary. The forthcoming Conservation Commission Meeting is slated for February 22, 2024, at 7 pm, during which the proposed activities will undergo review and approval. In preparation of the meeting, we have enclosed a copy of the Proposed Pond Management Plan and the accompanying Plan set, both integral components of the submitted Notice of Intent request.

Conservation Commission Meeting Information

TOWN OF NEEDHAM CONSERVATION COMMISSION
ZOOM VIRTUAL MEETING PLATFORM
Thursday, February 22, 2024
7:00 p.m.
Webinar ID: 82316889821

To listen, view and participate in this virtual meeting on your phone, computer, laptop, or tablet, download the “Zoom Cloud Meeting” app in any app store or at www.zoom.us. At the above date and time, click on “Join a Meeting” and enter the meeting ID: 82316889821 or you can use the link https://us02web.zoom.us/j/82316889821.

Needham, Massachusetts

Walker Pond Management Plan

Town of Needham Department of Public Works

February 2023

POND MANAGEMENT PLAN

89 Shrewsbury Street
Suite 300
Worcester, MA 01604
508.756.1600
www.BETA-Inc.com

Walker Pond Management Plan

Needham, Massachusetts

Town of Needham Department of Public Works

POND MANAGEMENT PLAN

Prepared by: BETA GROUP, INC.
Prepared for: The Town of Needham

February 2023

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1.0 EXECUTIVE SUMMARY

Walker Pond (the Pond) is a shallow waterbody with approximately six acres of surface area located in a residential neighborhood in Needham, Massachusetts as shown in **Figure 1-1: Site Locus**. In addition to being a local landmark and valuable natural resource, the Pond plays a crucial role in stormwater management for the surrounding area. The Pond has been experiencing water quality issues and excessive plant growth leading to poor wildlife habitat and prohibiting recreational use. The Town is proposing this management plan to reverse overgrowth and negative trends in water quality. Excessive plant growth has been observed by the community around the Pond for years and was determined to be caused by excess nutrient concentrations leading to an overgrowth of native plants. This vegetation overgrowth, and subsequent decomposition, has resulted in water quality issues including decreased water column depth and dissolved oxygen concentrations. The vegetation also caused maintenance issues at the outlet control structure and blockages in the downstream storm drain infrastructure. Details of the surveys and sampling efforts which led to this conclusion are included in Section 3.0.

Water quality has been impacted by long-term inputs of nutrients from the Walker Pond watershed. Phosphorus and nitrogen are nutrients that run off the surface of the watershed and build-up in the water and sediment, causing overgrowth within the Pond. Based on water quality sampling, phosphorus was determined to be the limiting factor for plant growth, which means that reducing phosphorus should reduce overall plant growth. This plan will focus primarily on how management strategies will reduce phosphorus, however most of these strategies will also result in nitrogen and TSS reductions.

Nutrient reduction efforts completed to date by the Town have focused on watershed-based management strategies, as described in Section 4.0. While watershed-scale practices will help reduce nutrient loading to the Pond, watershed-based management practices alone are not enough to completely counter internal nutrient loads. Additional work is needed to directly treat problems within the Pond, in addition to the watershed-based work currently being done by the Town, to address the water quality concerns.

The goal of this management plan is to define and address problems within the Pond and recommend management measures to restore Pond health. This Pond management plan will work with the larger effort by the Town of Needham to manage water quality and stormwater runoff in compliance with EPA's Municipal Separate Storm Sewer System Permit (MS4 Permit). This Townwide program is detailed on the Town stormwater website.

Through analysis of existing data and data collected for this 2023 study, recommendations for Pond management include actions to manage:

- Excessive growth of native vegetation
- Low densities of invasive species
- High concentrations of nutrients, primarily phosphorus
- High concentrations of *E.Coli*
- Low levels of dissolved oxygen

Due to the interconnected nature of these management challenges, the recommendations include a combination of chemical and mechanical options which will be flexibly used over time based on water quality testing and plant surveys. By following the science and moving slowly, this plan aims to solve existing problems within the Pond without causing new ones.

External watershed management remains a crucial part of Pond Management, therefore, the Town plans to continue implementing stormwater treatment projects in the wider watershed for the long-term success of this plan. In addition, action by residents and the Walker Pond Watershed Association on private properties to improve watershed conditions and reduce the potential for stormwater pollutant loading will be necessary to maintain sustainable nutrient loading.


GATEWOOD DR.
WHITE PINE RD.
WINDSOR RD.
STRATFORD RD.
SOUTH ST.
COUNTRY WAY
CHARLES RIVER ST.
WALKER POND
WALKER LN.
FISHER ST.
CENTRAL AVE.
OXBOW RD.
RIVER

2.0 Pond Characteristics

2.1 Site Description

Walker Pond (the Pond) is a six-acre eutrophic pond located along Walker Lane, which consists of two basins. The two basins are connected by a channel on the southern side of the land bridge, which allows water to travel from the inlet in the eastern basin to the outlet in the western basin. The eastern basin receives water from a small stream and a street drainpipe inlet along Charles River Street. Two inlets from small street drain systems enter the eastern basin along Walker Lane. The eastern basin also receives overland runoff from the parking lot at Walker Gordon Field and the field itself. The western basin contains an outlet structure which leads to a pipe system that was originally a stream channel, eventually discharging to the Charles River. The Pond provides storm damage prevention and flood control by detaining stormwater during rain events and regulating the rate and volume of flow entering the drainage system pipe under Central Avenue. See **Figure 2-1: Map of Walker Pond** for identification of these attributes and additional attributes as described below.

2.1.1 Hydrologic Characteristics

The elevation of the Pond is set by the weir height of the outlet control structure. Historically, based on record plans and various surveys, the Pond surface has been at or around elevation 222+/- Town Datum (115.6' NGVD88). The Pond elevation is variable based on the set height of the outlet control structure. In July 2023, the water level was recorded at 116.4' NGVD88 at the time of survey for this project due to the temporary metal plate that was installed to replace the failed stop log weir and excessive rains experienced over the summer. The Pond is overall a shallow pond with an average depth of 5.75' in the eastern basin and 4.96' in the western basin as measured to the top of soil during a historically wet season with elevated water levels in August 2023. Previous studies have reported the average depth at approximately 2.4' to 4' feet. The depth variation can be attributed to seasonal fluctuations, extended rainy or dry periods, and changes in the outlet control structure settings.

2.1.2 Boundary Information

Walker Pond consists of several parcels including a large town-owned parcel known by the Needham Assessor's Office as Map 210 Block 0023 and eight (8) other private parcels in southwestern Needham, Massachusetts. Existing conditions surrounding the Pond include forested areas and maintained lawn areas associated with the residential properties along Walker Lane. The Pond is bounded to the north by the Walker Gordon Field Recreational area and residential and undeveloped forested parcels to the south, east and west.

2.2 NHESP-Mapped Habitat and Other Sensitive Areas

No Natural Heritage and Endangered Species Program (NHESP)-mapped Priority Habitats of Rare Species or Estimated Habitats of Rare Wildlife are present near the Pond, nor are there any NHESP-mapped Certified or Potential Vernal Pools. The Pond is not located with surface water protection areas (Zone A, Zone B, Zone C) or wellhead protection areas (Zone I, Zone II, Interim Wellhead Protection Areas). In addition, there are no mapped Outstanding Resource Waters (ORW), Areas of Critical Environmental Concern (ACECs), or Coldwater Fisheries Resources located in the Pond.

Flow leaving Walker Pond travels through a culverted stream and discharges through a drain outfall directly into the Charles River. As an urban river, the Charles River is impaired by multiple pollutants and has many areas with altered and degraded habitat. There are two approved nutrient TMDLs for the

Charles River; one for the Lower Charles River Basin, published in 2007,[1] and one for the Upper/Middle Charles River Basin, published in 2011.[2] Needham resides in the Upper/Middle Charles River Basin. There is also a Pathogen TMDL for the Charles River Watershed, published in 2007. Charles River Watershed Communities are obligated to address impairments to meet allowable TMDL loads through the National Pollutant Discharge Elimination System (NPDES) General Permit for Stormwater Discharges. The efforts of this project will reduce nutrient loading and pollutants leaving Walker Pond and ultimately entering the Charles River.

[1] Massachusetts Department of Environmental Protection. 2007. Final TMDL for Nutrients in the Lower Charles River Basin. CN 301.1

[2] Massachusetts Department of Environmental Protection. 2011. Total Maximum Daily Load for Nutrients in the Upper/Middle Charles River Basin, Massachusetts. CN 272.0


Structure
Walker Gordon Field
TOWN OWNED LAND
TOWN OWNED LAND
WEST BASIN -
Inlet
CHARLES RIVER ST.
WALKER LN.
- EAST BASIN -
Connection Point on Berm Dividing Basins
TOWN OWNED LAND
TOWN OWNED LAND

3.0 Internal Pond Conditions Overview

Surveys of the Pond's water quality and aquatic vegetation were conducted on July 26, 2023 and October 13, 2023. The data acquired from 2023 water quality surveys for this project are summarized in Section 3.1 below and further detailed in **Appendix A**. Sediment sampling was conducted on August 21, 2023. This data is summarized in Section 3.2 below and further detailed in **Appendix B**. The full Water & Wetland report which includes information on vegetation monitoring and a preliminary alternatives analysis is available in **Appendix C**. The report provided by ESS for the survey completed on August 31, 2017 was consulted for comparison to the current survey results. This data is the basis for initial management decisions within the Pond as detailed below.

3.1 Water Quality Challenges and Excess Nutrients

Water quality and sediment sampling and analysis were conducted to evaluate the current chemical and biological conditions within the Pond. The water quality and sediment sampling conducted in Summer 2023 was completed in both the eastern and western basins of the Pond. Locations are identified on **Figures 3-1: Water Quality Sampling Locations** and **Figure 3-2: Soil Sampling Locations** and include both basins, with a particular focus on the deepest spots, the inlet to the eastern basin near Charles River Road, the outlet control structure in the western basin, and additional sediment sampling locations adjacent to storm drain pipe inlets from Walker Lane that discharge into the Pond. The sampling conducted in 2023 identified:

- Elevated levels of E. Coli immediately following a rain event in the vicinity including runoff from Walker Gordon Field,
- Consistently low levels of Dissolved Oxygen (DO),
- Higher than recommended levels of phosphorus in the water column, and
- A high percentage of releasable phosphorus in the Pond sediment.

High levels of E. Coli make the Pond unsuitable for recreation after rain events. High concentrations of phosphorus and low levels of DO make the Pond susceptible to dangerous algal blooms and fish kills. Additionally, high concentrations of phosphorus have led to overgrowth of vegetation within the Pond.

3.1.1 Water Quality Sampling Results

Water quality sampling is an important factor in selecting for treatment methods, particularly for maintaining the efficacy of vegetation removal programs. Below are the results of the sampling conducted in Summer and Fall 2023.

Table 3-1: Water Quality Sampling Results

Parameter	Units	1 -Inlet		2 - East Basin Deep Hole		3 - West Basin Deep Hole		4 - Outlet	
		July 26, 2023	Oct. 13, 2023	July 26, 2023	Oct. 13, 2023	July 26, 2023	Oct. 13, 2023	July 26, 2023	Oct. 13, 2023
Phosphorus, Dissolved	ppb	48	13	22	24	10	ND	10	ND
Phosphorus, Total	ppb	30*	112	50	52	31	39	39	36
Dissolved Oxygen	mg/L	5.36	4.82	5.27	2.90	3.48	3.49	3.30	2.76
Temperature	C	22.88	13.2	25.66	13.6	23.6	14.4	23.0	13.8
pH	-	6.8	6.63	6.9	6.9	6.70	6.81	6.8	6.78
E.Coli	MPN/ 100 mL	920.8	15.79	1299.7	8.6	275.5	<1	224.7	2.02

*Suspected sampling or laboratory error

The table above shows a comparison of results from four sampling sites on two sampling dates. The results highlighted in red were outside of the following recommended ranges:

Phosphorus, Total – Phosphorus in excess of 30 ppb can lead to excess plant growth which has been observed in Walker Pond.

E.Coli – E.Coli is a bacteria which can cause illness above certain thresholds. The State of Massachusetts has set the water quality standard for E.Coli at 410 MPN/100mL for recreational waters.

Dissolved Oxygen (DO) – DO below 5.0 mg/L is considered stressful for aquatic organisms and DO below 2.0 mg/L is considered likely toxic with sufficient exposure. Ponds typically have DO between 8.0 and 12.0 mg/L.

It should be noted that the sampling conducted on July 26, 2023, occurred after a rain event while the sampling completed on October 13, 2023 occurred during a dry period. Additional results from the July 26th sampling effort, including nitrogen sampling results, are included in **Appendix A**.

3.1.2 Excess Phosphorus

Nutrients are naturally occurring compounds which are necessary for healthy plant life and aquatic ecosystems. In ponds there are two nutrients that are needed for plant growth, phosphorus, and nitrogen. However, when a pond or lake contains too much phosphorus or nitrogen, they can cause excess plant growth and algal blooms.

The results of the water quality sampling efforts showed excess phosphorus at all sampling locations within the Pond. Reducing the concentration of phosphorus within the Pond will be necessary for managing nuisance vegetation.

3.1.3 E. Coli

The Massachusetts Surface Water Quality Standards (314 CMR 4.00) are designed to protect public health by limiting exposure in recreational waters when pathogens that may cause water-born illness are present. For recreational waters, this is done by monitoring for E. coli. E. coli is an ‘indicator’ bacteria which is frequently present in fecal matter from humans, pets, and wildlife. While E. coli does not necessarily cause illness, it is used to indicate that other illness causing pathogens may be present. During times of heavy rainfall, such as during the summer of 2023, high levels of E. coli are often found and are used to determine pond and beach closures.

Water quality sampling on July 26th was conducted following a significant rain event (0.77" recorded at the weather station in Norwood). The level of E. coli detected in Walker Pond was highest at the east basin deep hole sampling point and in all locations at levels unsuitable for recreation. Follow-up sampling conducted after over a weeklong dry period on October 13th found E Coli at low levels. The high E. coli level found in the east basin after the rain event is likely an indicator of pollutant contribution through overland runoff from Walker Gordan Field. E. coli will continue to be monitored throughout the Pond Management period and will need to be controlled through watershed management strategies.

3.1.4 Dissolved Oxygen

Dissolved Oxygen (DO) is important for biological and chemical processes, which are necessary to maintain a healthy pond ecosystem, including providing oxygen for aquatic life. DO fluctuates cyclically within waterbodies and is impacted by numerous factors including temperature, time of day, presence of aquatic life, amount of sunlight, and frequency of algal blooms. Current sampling efforts have shown low levels of DO within Walker Pond, with both basins at levels unable to support aquatic life. DO is normally inversely related to temperature, however there is a positive correlation between the July and October readings taken. This could be the result of factors such as time of day, weather, plant die-off, or stratification which could cause a temporary dip in DO during fall turnover. Due to the number of variables which impact DO, it is important to regularly monitor DO under different conditions and as changes are made to the Pond.

3.2 Sediment Sampling

Sediment sampling was conducted on August 21, 2023, at various locations within the Pond as required to evaluate sediment quality to inform management alternatives, including dredging. Sediment removal is anticipated as part of this project for replacement of the outlet control structure. It may also be required if hydroraking or dredging are selected methods for vegetation management. Therefore, the sampling effort was conducted to meet permitting requirements for various management alternatives. The effort was expanded to analyze additional parameters and locations to better understand the relationship between sediment composition and the water column phosphorus levels in the Pond.

3.2.1 Major 401 Water Quality Certification Sampling

Sampling was completed throughout the Pond to gather data in the event that hydroraking or dredging is a preferred alternative for pond management, since both of these activities would require a Major 401 Water Quality Certification (WQC) permit, as these management strategies are anticipated to generate greater than 100 cubic yards of sediment. Discussion of results from this sampling effort as they relate to the 401 WQC permit activities, and full sampling results, are included in **Appendix B**. Sediment sampling locations are shown in **Figure 3-2**. The results showed low-level exceedances mostly of the reporting limit for VOCs. Section 4 sampling showed elevated levels of chromium, which would need to be investigated further if dredging is considered in this area. Additional sediment sampling will be required in advance of dredging, as required for disposal and 401 WQC compliance.

3.2.2 Phosphorus Fractionation

During this effort, additional samples were collected at 7 sites which were sent to SePRO, an analytical lab located in North Carolina, to complete Comprehensive Level 2 Fractionations for phosphorus. These sites included composite samples at sections 1, 3, 5, and 7, as well as grab samples at 3 inlet locations, which are identified in **Figure 3-2**. The fractionation provides data on the type of phosphorus found in the samples and how it is expected to interact with the water column in the Pond.

For treatment considerations, phosphorus in sediment falls into three categories: biologically available, releasable, and non-available. Phosphorus that is biologically available or releasable can fuel plant growth and nutrient imbalance within the Pond, even after other sources of phosphorus are removed (such as watershed inputs or water column phosphorus). These two categories of phosphorus can be treated with various chemical compounds and should be addressed if plant growth continues after other sources of phosphorus are remediated. The results of the fractionation show that 63% of phosphorus in the sediment in the western basin can be treated and 43% of phosphorus in the eastern basin can be treated. These results can be used to inform application rates for any chemical treatment designed to address phosphorus in these sediments.

Additionally, this data can inform our understanding of where phosphorus within the water body is coming from and settling in the sediment. By investigating sediment phosphorus at the inlets to the pond, we now have a better picture of the quality of inputs coming from the urban watershed which can assist with targeting systems with high phosphorus loading during watershed management projects.

The results from both the 401 WQC sampling and the Comprehensive Level 2 Fractionations are further detailed in **Appendix B**.

3.3 Vegetation

A survey of aquatic vegetation was conducted within the Pond as part of Pond Surveys in 2017 and 2023. These surveys identified two invasive plant species in isolated locations, as well as various native species with some occurring at an abundance creating issues within the Pond. **Figure 3-3: Vegetation Coverage Map** displays the location of the aquatic vegetation by species as identified during the July 2023 survey.

3.3.1 Invasive Vegetation

An analysis of invasive vegetation identified purple loosestrife (*Lythrum salicaria*) and water chestnut (*Trapa natans*) within the Pond. During the 2017 survey, purple loosestrife was identified in low abundance within the Pond. It was not observed during the July 2023 survey but was observed by field staff during water sampling efforts in October 2023.

Conversely, water chestnut was not observed during the 2017 survey but was identified in low abundance during the 2023 survey. Invasive vegetation is generally in low abundance within the Pond, however, must be closely managed to prevent further establishment within the Pond.

3.3.2 Native Vegetation

The aquatic vegetation survey identified eleven (11) native species of varying abundance within the Pond. Identified species include:

- Coontail (*Ceratophyllum demersum*)
- Western Waterweed (*Elodea nutallii*)
- Duckweed (*Lemna sp.*)
- Yellow Waterlily (*Nuphar lutea variegate*)
- White Waterlily (*Nymphaea odorata*)
- Pickerelweed (*Pontederia cordata*)
- Watermeal (*Wolffia sp.*)
- Filamentous Algae (*Algae sp.*)

- Smartweed (*Polygonum sp*.)
- Cattails (*Typha sp*.)
- Pondweed (*Potamogeton sp.*)

Coontail, duckweed and watermeal were observed in high abundance between the two survey periods. These species are densely overgrown ,creating poor conditions for fish species and impeding recreation. Dense growth of smartweed along the edge of Walker Gordon Field was also observed. The Walker Gordon Field perimeter infiltration trench Best Management Practice (BMP) detailed in Section 4.2 has been developed to treat runoff from the field that is likely contributing to the excessive smartweed growth. **Table 5-1: Vegetation Treatment Coverage Map** in Section 5 provides more detail on the distribution of these species.

3.4 Flow

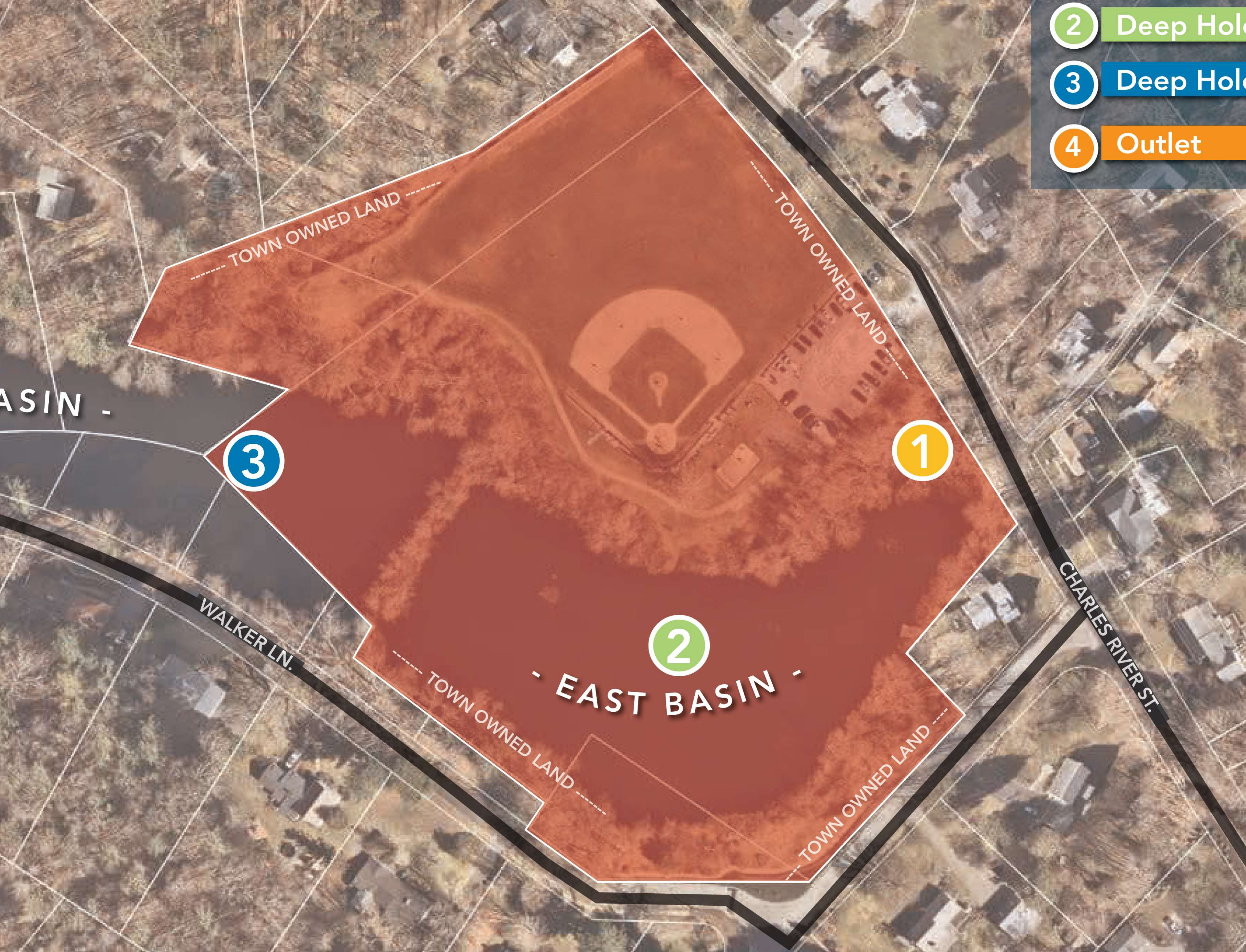
3.4.1 Outlet Control Structure

Natural water flow is important for managing nutrient levels within a water body. This is particularly true for Walker Pond because the Pond is part of a riverine system which eventually discharges into the Charles River. The Pond collects stormwater during rain events, detains these flows and discharges at a controlled rate to a culverted stream that provides storm damage and flood control functions. Flow allows nutrients that enter the water column to be carried downstream, while stagnation allows nutrients to remain within the Pond and eventually settle out into the sediment. In order to maintain the health of the Pond and the entire system, it is important that water be allowed to flow in and out of the Pond at a consistent rate. Balanced flow will not solve all of the Pond's nutrient problems but will help maintain balance within the Pond once it is achieved.

The existing structure that controls water flow out of the Pond experienced a failure of the stop log water control system that caused the Pond level to drain until and a temporary fix was installed. That structure is planned to be replaced with an improved outlet control system that can provide flexibility in the future for monitoring and treatment of the Pond. The Town is working with BETA to design and install a new outlet control structure in year one of the plan which will benefit the health of this system.

3.4.2 Earthen Berm

The earthen berm between the two basins is a major factor in the flow of water through the Pond which is reflected in the different vegetation and water quality found in each basin.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4.0 WATERSHED-BASED (EXTERNAL) POND MANAGEMENT

Walker Pond has been impacted by long-term inputs of nutrients such as nitrogen and phosphorus from development of the watershed that contributes stormwater runoff to the Pond. All impervious surfaces collect nutrients which eventually run off the surfaces of the watershed and build-up in the water and sediment, causing overgrowth within the Pond. Initiatives to address these stormwater inputs have been developed and implemented by the Town and the Walker Pond Watershed group over the past ten years. Nutrient load reduction efforts completed to date by the Town have focused on watershed-based (external) management strategies, as described below. Watershed-based Best Management Practices (BMPs) both installed and proposed are shown in **Figure 4-1: Walker Pond Watershed Boundary.**

4.1 COMPLETED PROJECTS

Sewer Main Extension
Prior phases of work on Walker Pond have focused on providing house connections to the Town's sanitary sewer through the sewer main extension completed in 2021. This reduces the opportunity for leaching from septic systems into the Pond.

Town Storm Drain System Best Management Practices
BMPs were installed to treat roadway stormwater in the area surrounding Walker Pond as summarized below:

Table 4-1: Inventory of BMPs in the Walker Pond Watershed

Location	BMP Type
Walker Lane	Vegetated filter strip with swale and infiltration trench/subsurface infiltration system consisting of leaching manholes surrounded by stone with a solid 4-foot sump in series connected with perforated pipe surrounded by stone
Charles River Street (between house #109 & #89)	Infiltration Basin
Throughout the Area	Catch Basin Markers (a program has been developed and is anticipated to be deployed in Spring 2024)

4.2 ONGOING PROJECTS

MS4 Permit and Phosphorus Control Planning
The Town of Needham is regulated as part of the 2016 National Pollutant Discharge Elimination System (NPDES) General Permit for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (MS4) in Massachusetts. As part of this permit, the Town of Needham is responsible for meeting water quality-based effluent limitations (WQBELs) including requirements for water bodies with approved Total Maximum Daily Loads (TMDLs).

The Town of Needham is within the TMDL area for the Charles River and therefore has requirements to reduce the phosphorus load leaving the Town. To meet this requirement, the Town developed a Phosphorus Control Plan (PCP) in 2023 which details the use of BMPs to reduce phosphorus. This plan is available on the Town website and details efforts to reduce phosphorus loading within the Walker Pond watershed area and the larger watershed which contains the Pond, Watershed 2.

As part of these requirements the Town plans to expand non-structural practices which will reduce the amount of Phosphorus runoff into the drainage system. These non-structural practices include cleaning catch basins and additional street sweeping. While these practices will be implemented to reduce phosphorus loading, they will also reduce nitrogen and TSS loads.

<u>Watershed 2 Analysis, Design, and Implementation</u>
The Town of Needham is taking a watershed-based approach to complying with its MS4 permit which is detailed further on the Town website. As part of this approach, BETA has prepared an analysis of Watershed 2 which breaks down phosphorus loading by catchment area. The Town, in collaboration with BETA, is in the process of using this analysis to site and design BMPs with the goal of reducing phosphorus throughout the entire watershed and eventually the entire Town. In addition to reducing phosphorus, these BMPs will also reduce nitrogen and TSS. It is anticipated that many or all of these designs will be compiled into a construction contract for installation in FY2025.

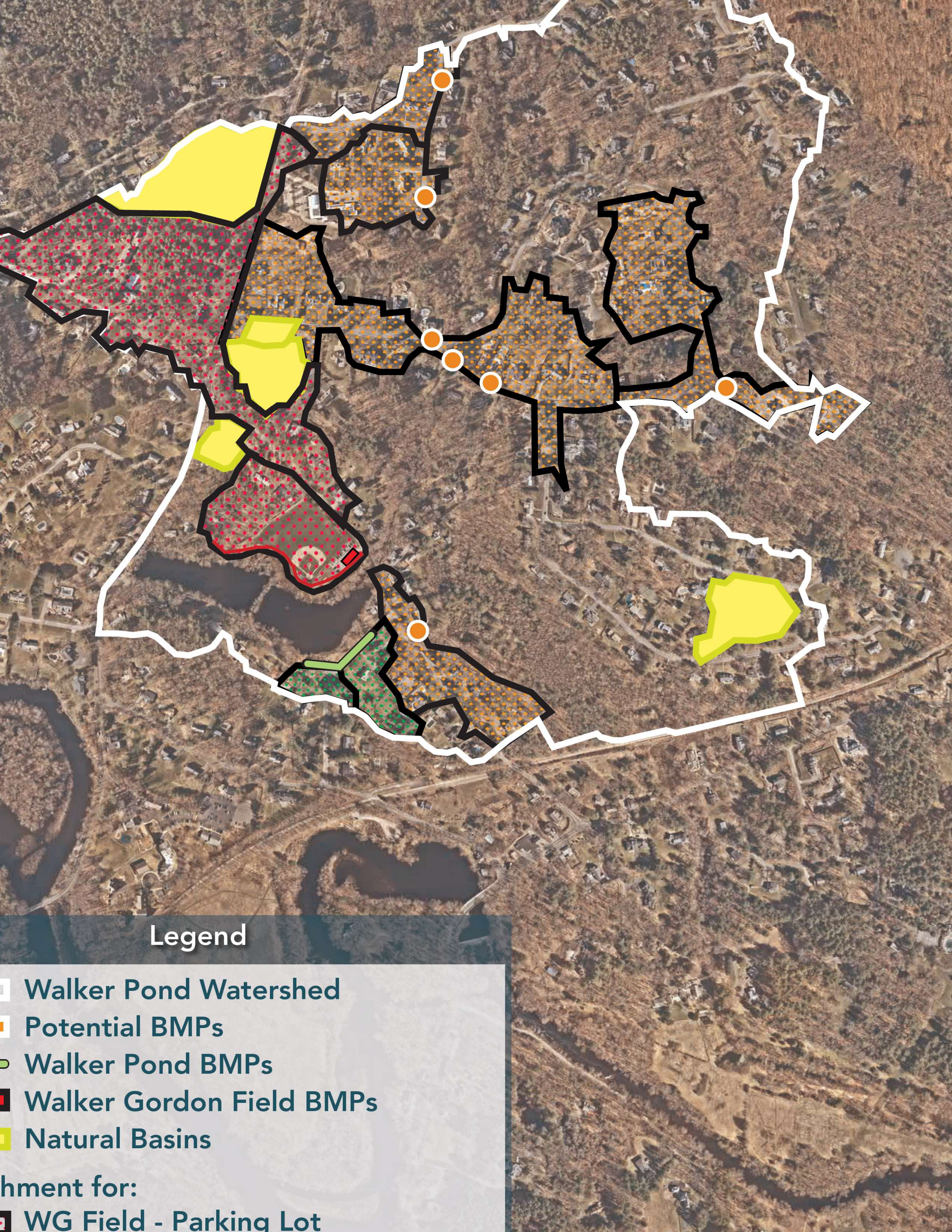
<u>Walker Pond Outlet Control Structure</u>
Walker Pond is a man-made pond with an outlet control structure where a stream used to exist and is now culverted under Central Avenue and through the Oxbow Road neighborhood. The main purpose of the outlet structure at Walker Pond is to control the pond elevation. The stop logs system currently in use has deteriorated and are no longer functioning necessitating a replacement of the structure. This structure is currently being designed by BETA and will be installed during Year 1 of this plan. The planned replacement outlet structure is being designed with improvements for the following:

- Maintain desired pond elevation and provide ability for the Town to modify the elevation if needed for pond management
- Maintain discharge flow so not to exceed the capacity of existing downstream system and provide capability to pass the 100-yr storm
- Public safety improvements
- Ability to perform water quality sampling
- Longevity, operations and maintenance ease & safety

<u>Walker Gordon Field BMP</u>
Based on aerial imagery of pond vegetation and on the ground observations, there is likely a significant contribution of nutrient and bacteria running from Walker Gordon Field, directly into the eastern basin of Walker Pond. This will be mitigated with installation of a perimeter infiltration trench to encourage infiltration of surface runoff from Walker Gordon Field before it discharges overland into the Pond. A second BMP is proposed to treat runoff from 15 ± acres of developed land upgradient of the park and includes installing a subsurface infiltration system under the gravel parking lot. These BMPs are currently being planned by the Town and designed by BETA. These BMPs are planned to be installed during the period of this management plan.

4.3 Future Management Projects

<u>Walker Gordon Field Maintenance Alterations</u>
Groundskeeping activities for Walker Gordon Field include application of fertilizer and herbicide to maintain the grass. Maintained grass area can be a significant contributor of excess fertilizer and other chemicals into adjacent waterbodies contributing to high nutrient levels. It is recommended that the Town review the field maintenance plan and implement measures to minimize application of fertilizers.


Legend
Walker Pond Watershed
Potential BMPs
Walker Pond BMPs
Walker Gordon Field BMPs
Natural Basins
hment for:
WG Field - Parking Lot

5.0 Internal Pond Management Nutrient Control

While watershed-scale practices will help reduce nutrient loading to the Pond, watershed-based management practice alone is not enough to completely counter internal nutrient loads. Additional work will be needed to directly treat problems within the Pond, through internal management methods.

The management strategy developed for Walker Pond consists of a combination of the external watershed-based strategies discussed above and internal water quality control measures and vegetation management strategies discussed in this section.

5.1 Nutrient Control

This section includes methods that are likely to be used for nutrient control for water quality or may be considered in the future. A full table with all considered management options is available in **Appendix D**.

5.1.1 Physical Controls

Several physical or mechanical methods are being considered to manage excess nutrients within the Pond.

Filter Tubes
Water and sediment sampling revealed high levels of phosphorus at the Charles River Street stream inlet and two inlets from Walker Lane that discharge stormwater to the Pond. In addition to the watershed level management mentioned above, filter tubes will provide additional reduction of phosphorus at these inlets.

The EutroSORB filter tubes are recommended for this application. These filters will be placed at each of the inlet points to reduce the amount of phosphorus flowing into the Pond. These filters need to be replaced every 8-12 weeks depending on rainfall, with more frequent replacements during periods of heavy rainfall. Unlike other nutrient control methods mentioned in this plan, these filters specifically target phosphorus within the runoff entering the Pond and do not control for other nutrients in runoff.

Aeration
Low levels of DO were identified within the Pond during water quality sampling, particularly in the western basin. Aeration is recommended to improve DO in the water column. However, this is complicated due to the shallow conditions and dense vegetation within the Pond. Aeration devices also require access to a power supply which does not currently exist at the Pond.

Surface aeration would require one or two units in each basin and would typically be the preferred method of aeration in a pond of this depth. However, they are prone to clogging in ponds with excess vegetation. Surface aerators work by utilizing a motor which mixes water to the surface, introducing oxygen to the water column through that movement. The units would be anchored in the Pond and powered from an extension cord plugged into an outlet source on the shore. Each year the unit would need to be placed in the Pond in the spring and removed before winter.

Subsurface aeration consists of weighted perforated hoses laid on the bottom of the pond surface connected to an air pump on the shore. These units work by introducing air to the bottom of the pond and distributing that upwards in a V shape. Multiple hoses would need to be installed throughout the pond due to the shallow depth. Once installed, these units would remain in place year-round.

Dredging
Sediment sampling revealed high levels of phosphorus bound to the soil in certain portions of the Pond, including near storm drainpipe inlets adjacent to Walker Lane, and the Inlet at the north end of the Pond.

Dredging of sediment is the most direct and effective method of removing excess nutrients bound up in sediment. While effective, dredging also requires significant impacts to the Pond, requires access for large machinery, and is significantly more expensive and intrusive than the other methods considered. Dredging may be considered later in the management timeline and would require further evaluation to determine specific areas that would benefit most.

5.1.2 Chemical Controls

Several chemical methods were considered to manage the internal phosphorus load that has accumulates in the water and in the soils. These compounds will be considered after at least one year of vegetation management and subsequent sampling is completed, likely during years 2-5 of the plan.

These include applying aluminum sulfate (alum) to the Pond which binds to phosphorus and causes it to fall out of the water column, forming a layer along the bottom of the Pond which can also reduce the release of phosphorus from the sediment. This method is generally effective within the water column, but higher doses would be required to treat phosphorus in the sediment. These higher concentrations would also require buffering with sodium aluminate to control for pH.

Other chemical controls were considered to manage phosphorus within the Pond, including EutroSORB WC and EutroSORB G. These compounds also precipitate phosphorus, with one formulation designed for use in the water column and the other for sediment. These formulations have not yet been approved for use in Massachusetts by MassDEP but will be considered in the future pending approval.

5.2 Vegetation Management

This section includes methods that are likely to be used for vegetation management or may be seriously considered in the future. A full table with all considered management options and an alternatives analysis is available in **Appendix D**. **Figure 5-1: Vegetation Treatment Coverage Map** shows the area where vegetation treatment will occur.

5.2.1 Target Species

This Management Plan aims to target species at nuisance densities that impede recreation and create poor water quality conditions. These species include native vegetation that have overpopulated and are now considered a nuisance within the Pond as well as invasive species. The various plant species identified in the Pond, along with their preferred habitat, ecological function, and options for management are identified in the table below.

Table 5-1: Target Plant Species

Plant Species	Habitat (Depth)	Habitat Function	Relative Abundance	Management options
Coontail (Ceratophyllum demersum)	Submerged (>1 ft)	Vegetative cover, seed food source	High	• Herbicide application • Hand Pulling
Western Waterweed (Elodea nutallii)	Submerged (>1 ft)	Vegetative cover, seed food source	Medium	• Hydroraking • Herbicide
Duckweed (*Lemna sp.*)	Surface (0 ft)	Nutrient absorption, vegetative food source	High	• Hand removal • Herbicide application

Plant Species	Habitat (Depth)	Habitat Function	Relative Abundance	Management options
Yellow Waterlily (*Nuphar lutea variegate*)	Surface (0.5 – 2 ft)	Vegetative Cover, edible roots	Medium	• Hydroraking • Herbicide
White Waterlily (*Nymphaea odorata*)	Surface (0.5 – 2 ft)	Vegetative cover, edible roots	Medium	• Hydroraking • Herbicide
Watermeal (*Wolffia sp.*)	Surface (0 ft)	Vegetative cover, vegetative food source	High	• Hand removal • Herbicide application
Filamentous Algae (*Algae sp.*)	Submerged (Any depth)	Vegetative food source	Medium	• Herbicide
Smartweed (Knotweed) (*Polygonum sp.*)	Wetland (<0.5 ft)	Seed food source	Medium	• Hydroraking • Herbicide
Purple Loosestrife (*Lythrum salicaria*)*	Wetland (<0.5 ft)	Pollinator food source	Low*	• Hand pulling • Long term monitoring
Water Chestnut (*Trapa natans*)*	Surface (0.5-2 ft)	Seed food source	Low	• Hand pulling • Long-term monitoring

**Denotes Invasive Species*

5.2.1.1 Manual/Mechanical Management Options

Hand Pulling

This method involves removing nuisance vegetation by hand, typically from a boat or using waders to access the vegetation. This method is very effective for small areas, where selectively managing species is important. It also minimizes plant fragments from breaking off and propagating within the area following removal. This method is not feasible for large or heavily overgrown areas as these may require larger equipment for effective management.

Hydroraking

This method involves deploying a floating backhoe type vehicle with a york rake that sifts through sediment to remove root masses and vegetation. This is particularly effective in areas with dense vegetation or for species such as water lilies with dense root masses. Hydroraking is a very disruptive process that creates substantial turbidity and plant fragments during vegetation removal and requires permitting for dredging from various agencies because of the disruption and removal of pond bottom sediment. This method also has very little selectivity and can kill wildlife that gets trapped in the rake.

Dredging

Dredging as a means of vegetation removal would be considered a last resort measure. This method involves removal of sediment from an area of a pond, along with the vegetation growing there. Dredging typically changes the water depth in the area that is dredged, which may change the type of vegetation that is able to grow there entirely. Extensive permitting through various agencies is required to pursue this option. Like with hydroraking, this method is not selective and creates significant turbidity and mortality of wildlife if the dredge area is not prepared properly. Removed sediment needs to be stockpiled and disposed of properly. Large equipment is required to complete dredging, which have specific access requirements to reach the dredge area in the Pond.

5.2.1.2 CHEMICAL METHODS

The currently proposed method for managing nuisance vegetation within the Pond is the use of herbicide. “Sonar” (fluridone) was recommended for use in Walker Pond due to the variety and density of nuisance vegetation. This formulation is designed to slowly break down vegetation by stripping away the plant’s natural sun protection and allowing sunlight to gradually kill the plant. The advantage of this herbicide is that it can target a large variety of nuisance species at the same time while maintaining beneficial species that are resistant to the herbicide.

Water and Wetland advises that Sonar treatment can provide increased open-water habitat, improved dissolved oxygen, and control of target species including dense coontail, elodea, watermeal, and waterlilies. They anticipate minimal impacts to native pondweed species, smartweed, and pickerel weed. Also, the slow-acting nature of this herbicide will prevent mass die offs of vegetation that could drive down DO levels within the Pond and lead to fish kills. The drawback of using this method is the long application period, typically 1-2 months, required for the formula to be effective. The correct concentration must be maintained throughout this period which means cost and effort may vary depending on rainfall and other environmental factors.

5.2.2 INVASIVE SPECIES MANAGEMENT

Purple loosestrife and water chestnut were the two invasive species identified during vegetation surveys of the Pond. Purple loosestrife was not observed during the July 2023 survey but was observed within the Pond in October 2023 during water quality sampling. Due to the sparse stands along the bank and low relative density of this species it could be effectively managed by hand pulling individual plants as needed. This is also true for water chestnut which was observed in low abundance within the Pond in discrete areas.

Hand pulling was selected over other mechanical methods such as hydro-raking primarily due to the low abundance within the Pond. Hand pulling allows for the individual plants to be removed by hand, eliminating the need for large equipment and cost and effort intensive permitting. Hand pulling is also a more targeted method than hydro-raking. Hydro-raking creates plant fragments that are able to spread and re-establish and should only be used in areas with a high abundance of invasive species.

Herbicide was not a feasible option as there is very little selectivity in applying herbicide in aquatic environments. Herbicides used for invasive species management are much stronger than Sonar and would negatively impact most of the native species within the pond.

The management plan will include monitoring as part of ongoing, long-term maintenance of the Pond to address any expansion or new introductions of these species.

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6.0 Long Term Management Plan

6.1 Management Approach

Ponds are complex ecosystems, which this plan acknowledges by proposing an adaptive approach to management. While the plans for the first year are fully defined, the plans for future years presented below and in **Figure 6-1: Walker Pond Management Timeline** allow for different options based on the results of vegetation and water quality monitoring. By allowing for flexibility to address future challenges, it is anticipated that the recommendations presented in this plan will not need to be changed significantly for the duration.

6.2 Initial Treatment

The initial treatment of the Pond will focus on removing excess plant growth and addressing invasive species.

6.2.1 Vegetation Control

The initial means to control excessive plant growth will be through herbicides and hand pulling.

Herbicide treatment will include an initial dose of Sonar (fluridone) to achieve the recommended treatment concentration of 10 ppb. This dosage will be implemented by mid-May to allow for the treatment to be maintained within the Pond for the recommended 45-60+ days while plant growth is still occurring. Sonar is currently being used to control Fanwart in the Charles River.

Hand pulling will be used to control for water chestnut and purple loosestrife. It is crucial that this treatment be implemented in year 1 to prevent the spread of the plants and prevent the need for more invasive and expensive mechanical removal methods. Due to the longevity of the seed pods for water chestnut, this management plan includes surveying for water chestnut and hand pulling as needed for the duration.

6.2.2 Water Quality Management

The focus for the first year of this plan will be on managing nutrient inputs through watershed control measures. This will be completed as part of the Phosphorus Control Plan and Watershed 2 Design Project which are available through the Town engineering department. Additionally, a BMP at Walker Gordon Field is being designed to reduce and treat runoff from the field and Charles River Street. Installation of an electric service to the Pond will be considered as part of this design in in preparation and to determine feasibility for installation of aeration units to address dissolved oxygen in the second year of this plan. Eutrosorb filters will be installed at inlets to the Pond to reduce phosphorus input into the Pond.

It will be important for water quality sampling to continue as plant management controls are put in place. This water quality data will guide decision making for future planning.

6.3 Second Year

6.3.1 Vegetation Control

A vegetation survey will be conducted and a series of water samples will be collected to verify the effectiveness of the previous year's management activities. Based on the results of this survey, additional contact herbicide applications in limited locations or additional mechanical measures may be necessary to address excess growth. A survey for water chestnut and purple loosestrife will be conducted and hand pulling will be implemented as necessary.

6.3.2 Water Quality Management

In addition to ongoing watershed work to control for nutrients and depending on the success of Year 1 vegetation control, the treatment plan for year 2 will consider measures to address dissolved oxygen and internal phosphorus loading. Dissolved oxygen concentrations vary greatly due to numerous factors including overall plant growth within the Pond. If dissolved oxygen readings are still at levels of concern, aeration options will be considered and implemented.

6.4 Years 3 through 5

Additional treatment for both vegetation control and water quality management may be needed in years 3 through 5 depending on monitoring results.

6.4.1 Vegetation Control

Based on the results of ongoing monitoring, contact herbicide applications or mechanical methods may be needed to control plant growth. This is highly dependent on the results of the Sonar treatment in year 1 and the status of invasive species within the Pond. The Pond will continue to be monitored for water chestnut and purple loosestrife and hand pulling will be implemented as necessary.

Another concern that may arise are algal blooms, particularly harmful algal blooms (HABs). HABs occur in nutrient rich environments and may occur after changing the Pond ecosystem. There are algaecides available that may be considered for treatment if HABs or nuisance algal blooms arise during the management process.

6.4.2 Water Quality Management

In addition to the possible management strategies detailed above, additional controls may be needed to address high phosphorus levels within the Pond sediment. Phosphorus exists in a cycle which allows it to move between the sediment and water depending on water quality conditions. If the levels of phosphorus within the Pond are still high after controls at the inlet and surrounding watershed have been implemented, alum or other flocculating agents will be considered to reduce the amount of phosphorus being released from the sediment. Additionally, further investigation into the impact of the berm separating the two basins on water quality will be conducted.

6.5 Ongoing Management

Ongoing work for this Pond will include water quality sampling and monitoring of vegetation and invasive species. Depending on the effectiveness of proposed vegetation management, particularly of invasive species, long term management may be required. This includes periodic vegetation surveys to ensure that no invasive species remain, and water testing verify that nutrient levels remain at ideal levels.

Throughout the implementation of this plan, BETA will work with the Town to evaluate new technologies that may become available, with the potential to incorporate them into the management strategy if proved to be effective.

The pond management plan should be updated periodically (every five years) to ensure progress and to incorporate any changes in watershed activities and within the pond itself. It is anticipated that the work proposed in this plan will help to restore balance to the Pond. However, that balance will need to be maintained once it is restored. Future maintenance plans should benefit from this initial investment in the ecological health of Walker Pond.

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1

YEAR 2

Spot treatment with herbicides as needed & design aeration.

weed control
year 1&2 results, install aeration & evaluate sediment management needs.

YEAR 3

YEAR

Evaluate yea
plan sediment
as needed, pla
managem

ANNUAL TASKS

Water Quality monitoring will continue for the duration of the plan.
management will include monitoring and hand pulling as-needed.
with herbicides and aeration will continue on as-needed basis after initial implementation.


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OXBOW ROAD
VILLAGE LANE
CHARLES RIVER STREET
GORDON FIELD
WALKER POND
WALKER LANE
NTRAL AVENUE
PROJECT
LOCATION

MH	MANHOLE
NTS	NOT TO SCALE
PRF	POST RAIL FENCE
PROP	PROPOSED
PVC	POLY–VINYL–CHLORIDE PIPE
RCP	REINFORCED CONCRETE PIPE (CLASS III UNLESS NOTED)
SMH	SEWER MANHOLE
STD	STANDARD
TYP	TYPICAL
T&B	TOP AND BOTTOM
UP	UTILITY POLE
VCP	VITRIFIED CLAY PIPE
VGC	VERTICAL GRANITE CURB.
WG	WATER GATE

MATERIAL TO BE DISPOSED OF SHALL
MATERIAL ON A DAILY BASIS.

9. BASE PLANS AND TOPOGRAPHY
NEEDHAM SURVEY.

10. ALL ELEVATIONS REFER TO NAVD
POINTS.

11. ANY EXISTING PIPE OR UTILITY
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12. CONTRACTOR SHALL INSTALL, MA
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14. THE CONTRACTOR SHALL COORD
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15. THE CONTRACTOR SHALL SUBMIT
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16. THE CONTRACTOR SHALL IMMEDI

17. ALL FRAMES, GRATES, COVERS,
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18. INVERTS AND DIRECTIONS OF PI
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19. ALL GRASSED AREAS DISTURBED
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INDICATED.

20. ALL CURBING AND SIDEWALKS D
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OTHERWISE INDICATED.

21. AREAS OUTSIDE THE LIMITS OF
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22. THE CONTRACTOR SHALL SUBMIT
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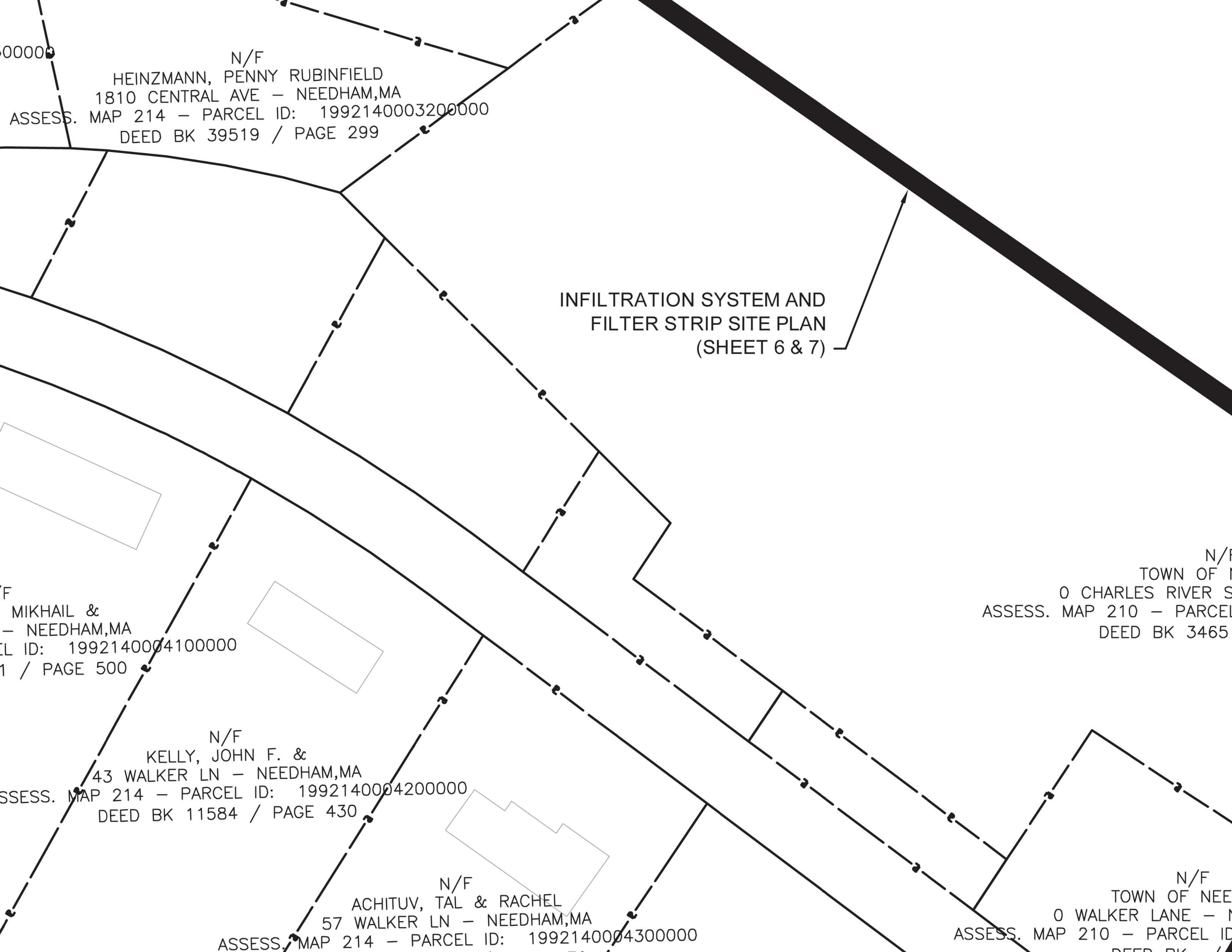

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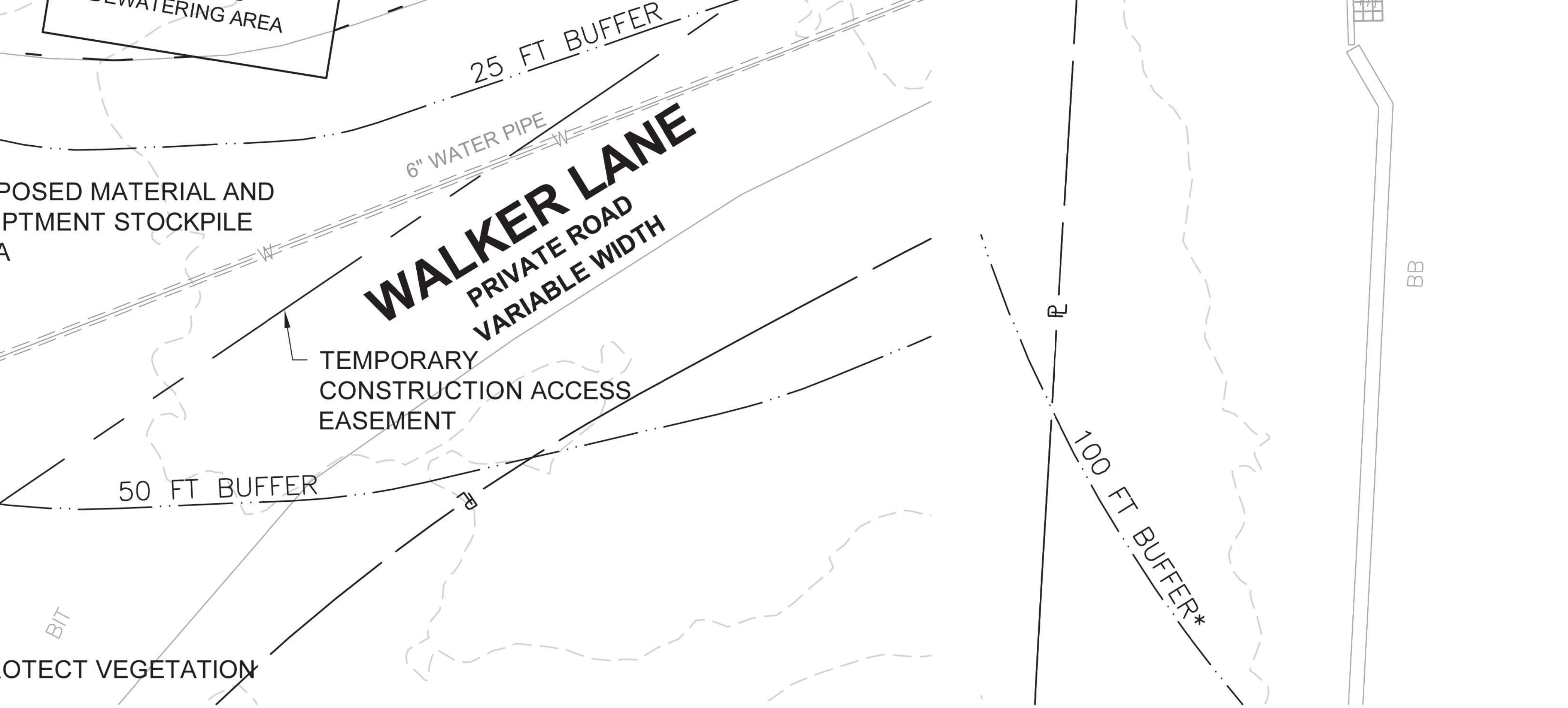

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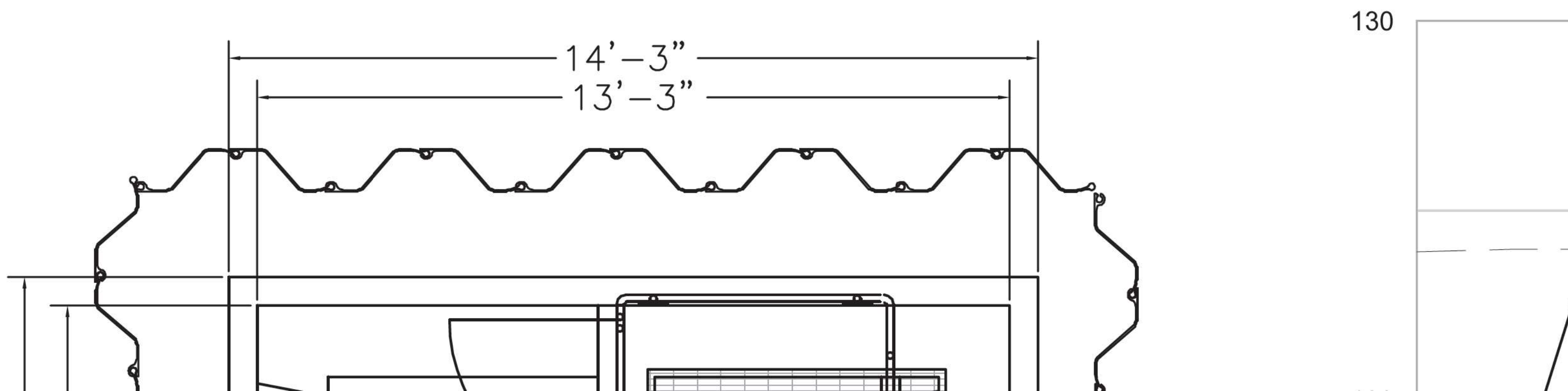


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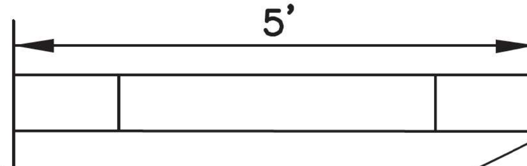
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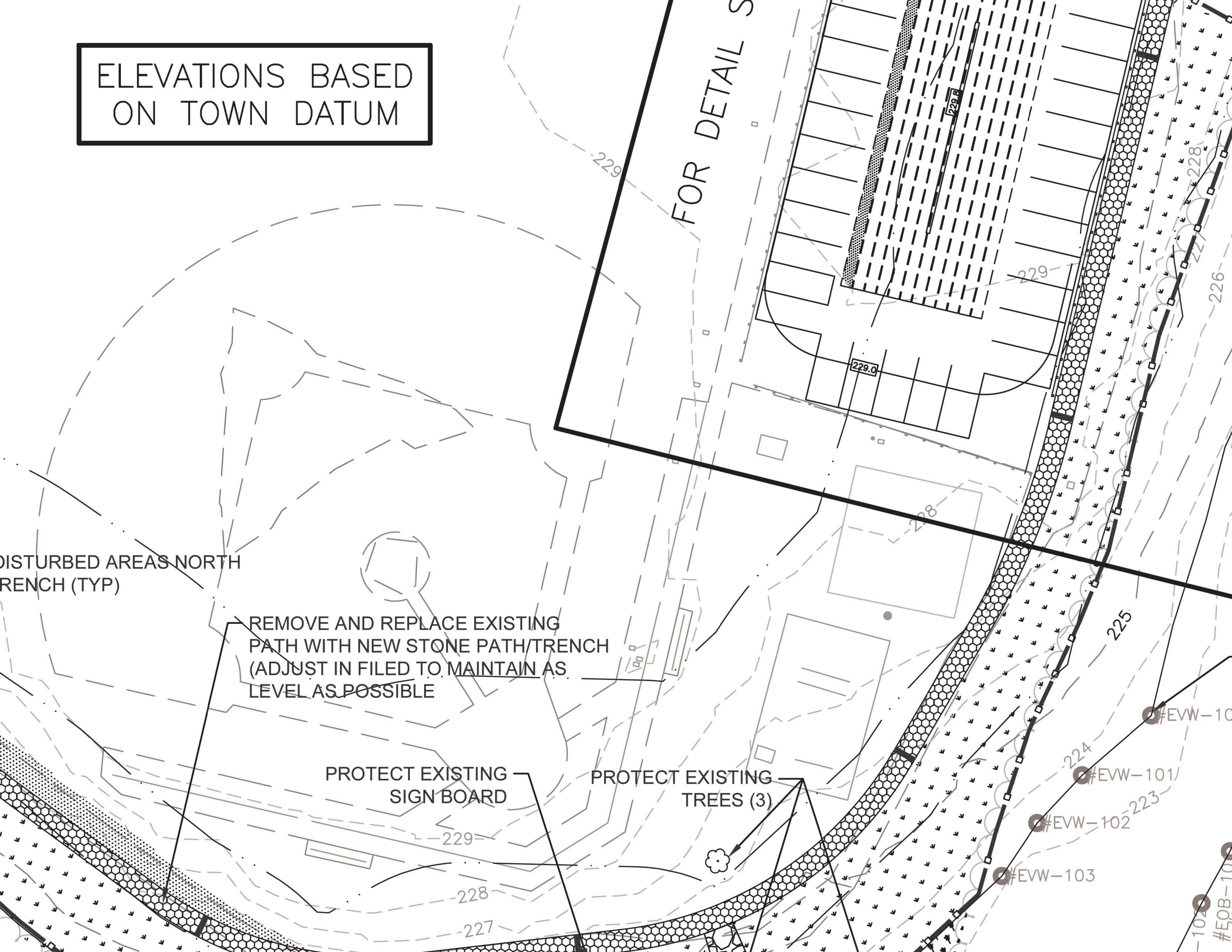

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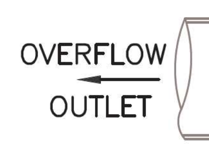

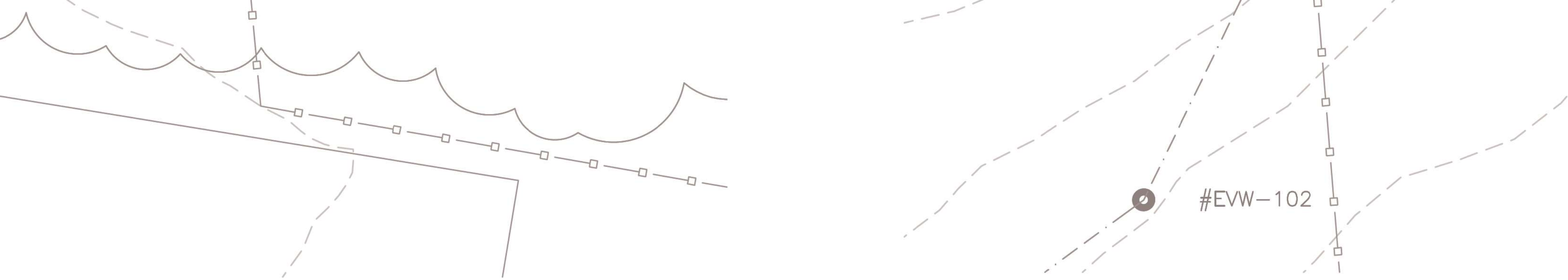

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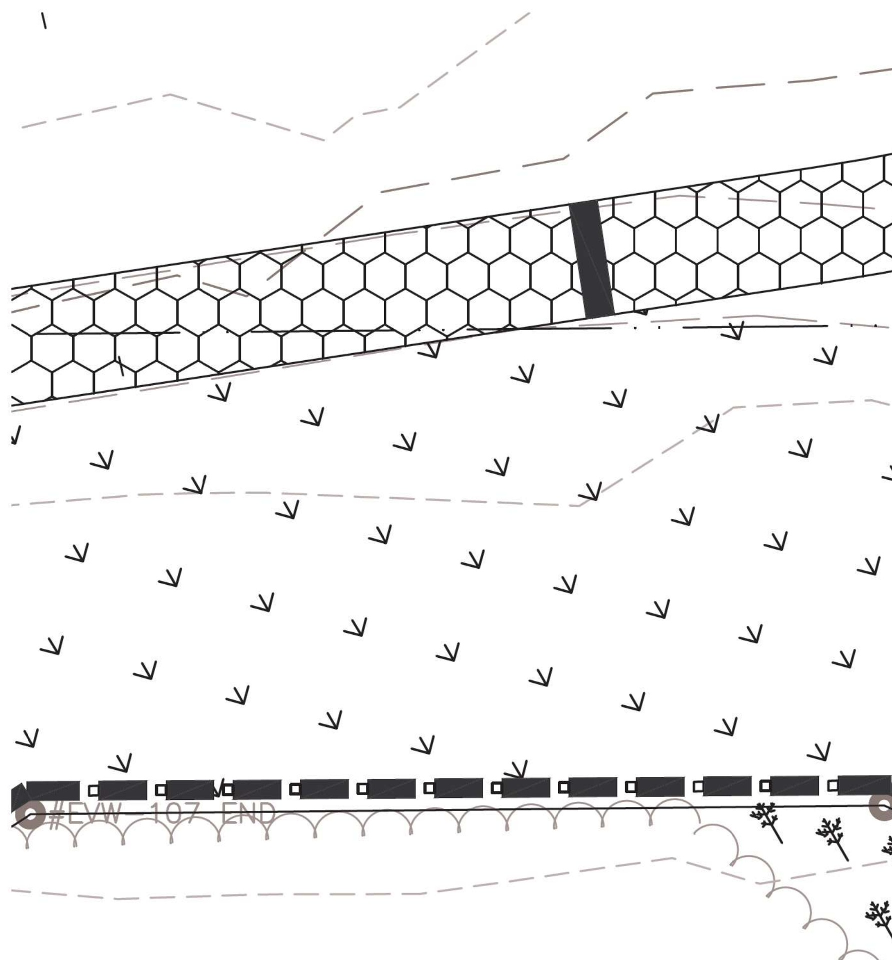

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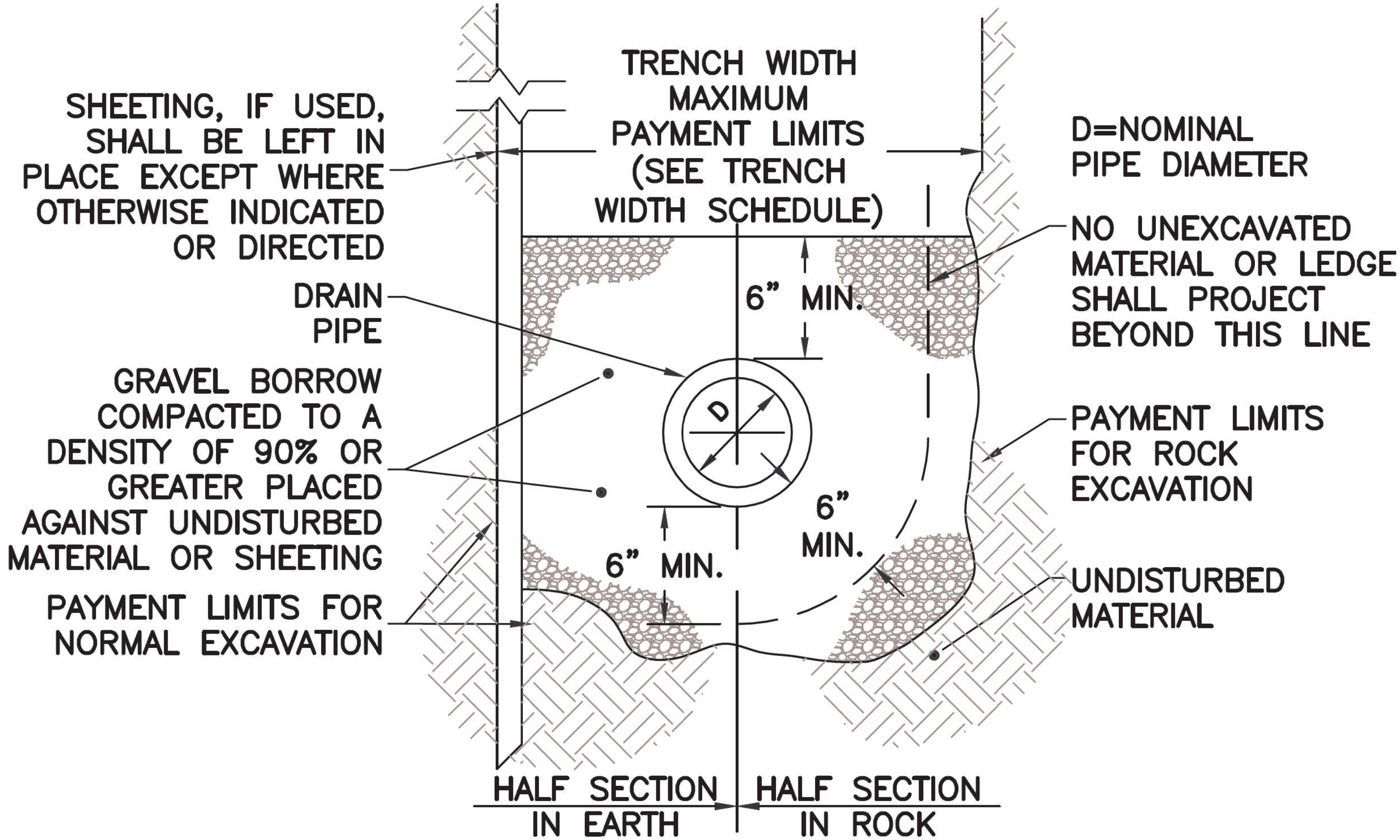
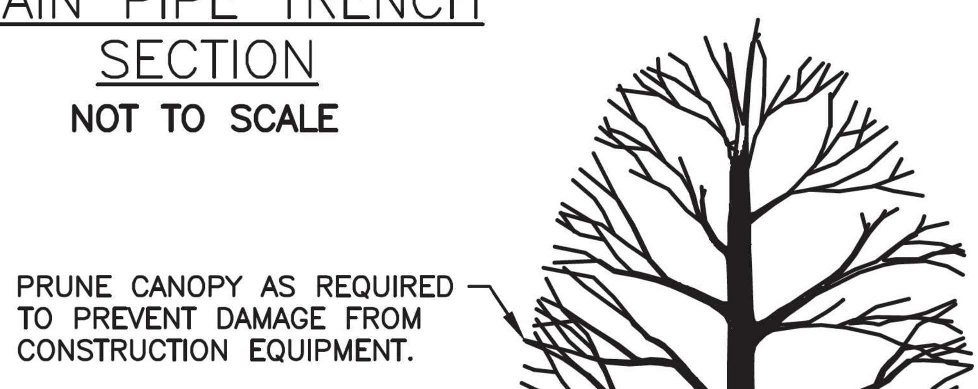


DRAIN PIPE TRENCH SECTION
NOT TO SCALE



OTEXTILE SHALL BE BLACK IN APPEARANCE.

OTEXTILE SHALL HAVE A TYPICAL WEIGHT OF 4.5 OZ/SY (142 G/M).

OTEXTILE SHALL HAVE A TENSILE STRENGTH VALUE OF 120 LBS (533 N) PER ASTM D4632 TESTING METHOD.

OTEXTILE SHALL HAVE AN ELONGATION @ BREAK VALUE OF 50% PER ASTM D4632 TESTING METHOD.

OTEXTILE SHALL HAVE A MULLEN BURST VALUE OF 225 PSI (1551 KPA) PER ASTM D3786 TESTING METHOD.

OTEXTILE SHALL HAVE A PUNCTURE STRENGTH VALUE OF 65 LBS (289 N) PER ASTM D4833 TESTING METHOD.

OTEXTILE SHALL HAVE A CBR PUNCTURE VALUE OF 340 LBS (1513 N) PER ASTM D6241 TESTING METHOD.

OTEXTILE SHALL HAVE A TRAPEZOID TEAR VALUE OF 50 LBS (222 N) PER ASTM D4533 TESTING METHOD.

OTEXTILE SHALL HAVE A AOS VALUE OF 70 U.S. SIEVE (0.212 MM) PER ASTM D4751 TESTING METHOD.

OTEXTILE SHALL HAVE A PERMITTIVITY VALUE OF 1.7 SEC-1 PER ASTM D4491 TESTING METHOD.

OTEXTILE SHALL HAVE A WATER FLOW RATE VALUE OF 135 GAL/MIN/SF (5500 L/MIN/SM) PER ASTM D4491 TESTING METHOD.

OTEXTILE SHALL HAVE A UV STABILITY @ 500 HOURS VALUE OF 70% PER ASTM D4355 TESTING METHOD.

IO. 4800™ WOVEN GEOTEXTILE

. 4800 WOVEN GEOTEXTILE IS DESIGNED AS A UNDERLAYMENT TO PREVENT SCOURING CAUSED BY WATER MOVEMENT WITHIN THE CULTEC AND FEED CONNECTORS UTILIZING THE CULTEC MANIFOLD FEATURE. IT MAY ALSO BE USED AS A COMPONENT OF THE CULTEC SEPARATOR ROW TO ARRIER TO PREVENT SOIL/CONTAMINANT INTRUSION INTO THE STONE WHILE ALLOWING FOR MAINTENANCE.

LE PARAMETERS

GEOTEXTILE SHALL BE BLACK IN APPEARANCE.

GEOTEXTILE SHALL HAVE A TENSILE STRENGTH OF 550 X 550 LBS (2,448 X 2,448 N) PER ASTM D4632 TESTING METHOD.

GEOTEXTILE SHALL HAVE A ELONGATION @ BREAK RESISTANCE OF 20 X 20% PER ASTM D4632 TESTING METHOD.

GEOTEXTILE SHALL HAVE A WIDE WIDTH TENSILE RESISTANCE OF 5,070 X 5,070 LBS/FT
74 KN/M) PER ASTM D4595 TESTING METHOD.

GEOTEXTILE SHALL HAVE A WIDE WIDTH TENSILE RESISTANCE @ 2% STRAIN OF 960 X 1,096 LBS/FT
16 KN/M) PER ASTM D4595 TESTING METHOD.

GEOTEXTILE SHALL HAVE A WIDE WIDTH TENSILE RESISTANCE @ 5% STRAIN OF 2,740 X 2, 740 LBS/FT (40 X 40 KN/M) PER ASTM D4595 TESTING OD.

GEOTEXTILE SHALL HAVE A WIDE WIDTH TENSILE RESISTANCE @ 10% STRAIN OF 4,800 X 4,800 LBS/FT (70 X 70 KN/M) PER ASTM D4595 TESTING OD.

GEOTEXTILE SHALL HAVE A CBR PUNCTURE RESISTANCE OF 1,700 LBS (7,560 N) PER ASTM D6241 TESTING METHOD.

GEOTEXTILE SHALL HAVE A TRAPEZOIDAL TEAR RESISTANCE OF 180 X 180 LBS (801 X 801 N) PER ASTM D4533 TESTING METHOD.

GEOTEXTILE SHALL HAVE AN APPARENT OPENING SIZE OF 40 US STD. SIEVE (0.425 MM) PER ASTM D4751 TESTING METHOD.

GEOTEXTILE SHALL HAVE A PERMITTIVITY RATING OF 0.15 SEC-1 PER ASTM D4491 TESTING METHOD.

GEOTEXTILE SHALL HAVE A WATER FLOW RATING OF 11.5 GPM/FT2 (470 LPM/M2) PER ASTM D4491 TESTING METHOD.

GEOTEXTILE SHALL HAVE A UV RESISTANCE OF 80% @ 500 HRS. PER ASTM D4355 TESTING METHOD.