# Passaic Valley Water Commission

## WATER STORAGE IMPROVEMENTS FINAL CONCEPTUAL DESIGN REPORT

Passaic Valley Water Commission
1525 Main Avenue, Clifton, NJ 07011

APRIL 2011

Prepared by:

# 1.0 EXECUTIVE SUMMARY

## 1.1 General Background and Introduction

Passaic Valley Water Commission (PVWC) is a publically owned water purveyor located within the northern New Jersey water supply region. PVWC has three uncovered, finished water reservoirs, including Great Notch, New Street, and Levine Reservoirs. The Great Notch and New Street Reservoirs are both located in Woodland Park, with Levine Reservoir being located in the City of Paterson.

These reservoirs are presently not in conformance with current applicable New Jersey Department of Environmental Protection (NJDEP) and USEPA regulations for finished water storage. In March of 2009, the NJDEP issued an Administrative Consent Order (ACO) to PVWC. NJDEP provided PVWC with a schedule that required producing a feasibility study for addressing the regulatory requirements of the existing uncovered finished water reservoirs. The Water Storage Improvements Feasibility Study (September 2010, revised April 2011) was prepared to address these requirements. This Conceptual Design Report serves to further develop the selected alternative and to create a more accurate cost opinion for this work.

## 1.2 Great Notch

The primary purpose of the Great Notch Reservoir is to supply the water distribution system in the event that the Little Falls Water Treatment Plant (LFWTP) is out of service. The reservoir also supplies the Valley Heights (through Woodland Park), Woodland Park, and Valley Road Service areas (427 Gradient).

A plan of the proposed improvements to the Great Notch area is shown on Drawing No. 005 of Appendix A. The main improvements consist of:

- Replace Great Notch Reservoir with two 20-million gallon (MG) tanks,
- New access roads,
- New piping to connect the tanks to existing reservoir inlet and outlet piping,
- New piping to connect the tanks to existing Great Notch/New Street interconnect pipeline,
- Partial demolition of the Great Notch Dam,

- A new utility building,
- Stormwater improvements, and
- Improvements to the Great Notch Pump Station with the following functions:
  - Provide an additional variable speed pump in the Great Notch Pump Station, equal in capacity to each of the existing two pumps [6.0 million gallons per day (mgd)] to provide standby pumping during emergency situations or when the reservoir needs to be filled.

## 1.3 New Street

The primary purpose of the New Street Reservoir is to provide storage for the 300 Gradient (and indirectly the 330 Gradient). This existing reservoir is too low to supply the 330 Gradient, so the 330 Gradient was created by throttling a valve on the supply line to the 300 Gradient.

A plan of the proposed improvements to the New Street area is shown on Drawing No. 008 of Appendix A. The main improvements consist of:

- Replace New Street Reservoir with two 15-MG tanks,
- A new access road,
- New piping to connect the tanks to existing Great Notch/New Street interconnect pipeline and the existing reservoir outlet piping,
- Complete demolition of the New Street Dam,
- Demolition of the Garret Heights Pump Station and the original New Street Pump Station, and
- A new pump station (New Street Pump Station) containing a total of five split case centrifugal pumps, a flow control valve and space for a future hydroelectric turbine with the following functions:
  - Transfer water from the 300 Gradient to the Great Notch Tanks.
  - Supply water demands of the Garret Heights Gradient and thereby replace the existing New Street Pump Station.
  - Supply booster capacity pump for the Garret Heights Gradient and thereby replace the Garret Heights Pump Station.
  - Provide a flow control valve to control and meter the flow from the Great Notch Tanks.

- Provide space for a future hydroelectric turbine to produce energy from the Great Notch Tanks.
- Stormwater improvements.

## 1.4 Levine

The primary purpose of the Levine Reservoir is to supply the 300/330 Gradient with emergency and fire flow storage (via the East Side, Botany and Great Falls Pump Stations) and to supply 180 Gradient with equalization, fire flow, and emergency storage. This reservoir historically served an industrial area, but many of the industrial facilities are no longer in this zone. As such, the demand has been significantly reduced in the 180 Gradient.

A plan of the proposed improvements to the Levine area is shown on Drawing No. 011 of Appendix A. The main improvements consist of:

- Replace Levine Reservoir with two 2.5-MG tanks,
- A new access road,
- A new utility building,
- New piping to connect the tanks to existing reservoir inlet and outlet piping,
- Separating the remaining portion of the reservoir from the water distribution system, and
- Stormwater improvements.

## 1.5 Standby Energy Generators

The various parts of the LFWTP and the pump station located at the treatment plant can receive power from either of two locations. Some locations can be powered from either side of the Switchgear A, while others can be powered from one side of Switchgear A or Switchgear MV. At some locations, large loads are powered directly at 2.4 kV.

Hydroelectric generators at the main pump house can provide some of the plant's power, offsetting Public Service Electric & Gas (PSE&G) energy consumption. These generators lack the level of control required for stand-alone operation, and cannot generate sufficient reliable power to provide significant plant production.

Based on the feasibility study, it was decided that standby generator capacity was required at the LFWTP (above the existing 1500 kW generator for the Verona, Totowa and Airport Pumps). This proposed standby generator capacity consists of four 2,500-kW diesel generators. This preliminary design could provide a total of 81 mgd of capacity from the LFWTP and would include 25 mgd from Wanaque Finished Water Supply, as well as

56 mgd of treatment plant and pumping capacity. Original the feasibility study discussed the concept of retrofitting diesel generators with the capability to supplement with natural gas. Due to problems in the industry with de-rating, generator responsibility, and warranty, we do not recommend including this feature in the generator design. This cost option includes meeting the more stringent 2011 air quality requirements for generators.

### 1.6 Cost Opinion

The overall construction cost opinion for all of the improvements is $112,500,000.

## 2.0 GENERAL BACKGROUND AND INTRODUCTION

PVWC provides public water utility service for more than 600,000 retail customers in the owner cities of Clifton, Passaic, and Paterson, as well as direct customers such as Elmwood Park, Fairlawn, High Crest, Little Falls, North Arlington, Prospect Park, West Paterson, and Woodridge. In addition, PVWC is a major wholesale supplier of water. It has contracted with 25 towns and public water suppliers to provide all or part of the water supply needs of the communities served by these utilities. Approximately 38 percent of PVWC's production was consumed by wholesale customers (2007 to 2008).

PVWC has four different sources of raw water supply which include the Passaic River Intake, Pompton River intake (via the Wanaque South Pipeline), Point View Reservoir (via discharge to the Pompton River/Passaic River), and Point View Reservoir (via the Wanaque South Aqueduct and Wanaque South Pipeline).

PVWC operates the LFWTP, which has an overall finished water capacity of 110 mgd and a firm capacity of 85 mgd.

Water flows by gravity from the LFWTP to the Main Pump Station. The Main Pump Station was constructed over 100 years ago. The Main Pump Station consists of the following pump systems:

- Industrial Pumps,
- Transfer Pumps,
- Wanaque Pumps,
- Totowa Pumps,
- Verona Pumps,
- Airport Pumps, and
- Morris County Pumps.

### 4.3.3 Cost Opinion

The total cost for the New Street Pump Station is $3,100,000. A detailed breakdown of the costs is located in Appendix B. The earthwork required for the pump station was accounted for in the tank cost opinion in the preceding section since much of this would occur as the existing reservoir was demolished and the new tanks were built. The cost of the future hydroelectric turbine is not included.

# 5.0 LEVINE

## 5.1 Existing Conditions and Background

The primary purpose of the Levine Reservoir is to supply the 300/330 Gradient with emergency and fire flow storage (via the East Side, Botany and Great Falls Pump Stations) and to supply the 180 Gradient with equalization, fire flow, and emergency storage. It was originally know as the Stony Road Reservoir and later as the Grand Street Reservoir before its name was recently changed to the Levine Reservoir. This reservoir historically served an industrial area, but many of the industrial facilities are no longer in this zone. As such, the demand has been significantly reduced in the 180 Gradient.

The Levine Reservoir is located within Great Falls National Park.

### 5.1.1 Capacity and Physical Configuration

The Levine Reservoir was constructed circa 1885. The Levine Reservoir's full capacity is 19.2 MG at a maximum water depth of 18 feet (HGL of 180 feet). When full, the surface area of the reservoir is approximately 4 acres.

The reservoir bottom is on bedrock, and some of the reservoir walls appear to be constructed of concrete. The reservoir has a perimeter of approximately 1,800 feet. Reservoir depth is approximately 18 feet at its deepest location, but most of the reservoir is less than 10 feet.

The Levine Reservoir is connected to the 180 Gradient by a 48-inch transmission main. The 48-inch transmission main connects to the 51-inch transmission main that provides water to the 180 Gradient from the Hydraulic Switchboard. Water enters and exits the Levine Reservoir through an outlet chamber at the south end of the reservoir where it is chlorinated before it connects to a 48-inch transmission main that serves Paterson. The outlet structure from the reservoir has a manually cleaned screen. There is also a bypass pipeline, which is used to directly connect the inlet and the outlet of the reservoir. This allows for the reservoir to be removed from service. Recently, the inlet main to the reservoir has been shut to avoid the potential of unchlorinated water backfeeding into the 180 Gradient.

Accordingly, the outlet main from the reservoir serves as both a fill and draw line and the reservoir floats on the system. There also is a pipeline from the New Street Reservoir, which supplies water to the Levine Reservoir. This pipeline helps maintain water quality in the Levine Reservoir. Drawing No. 004 of Appendix A shows this pipeline.

### 5.1.2 Historical Operation (Flow Patterns, Daily Variation, and Hydraulic Grade Lines)

Normally, the Levine Reservoir provides equalization storage to the 180 Gradient and provides suction to the Botany Pump Station. The Botany Pump Station is operated to assist with low pressure areas in the 300 Gradient. During power outages at the LFWTP or fire flow conditions in the 300 Gradient, the East Side and Great Falls Pump Stations boost water from the 180 Gradient to the 300 Gradient. A general piping schematic for Levine (with the Levine Tanks replacing the Reservoir) and the rest of the PVWC water system is shown on Drawing No. 003 of Appendix A.

The lowest historical operating level in the Levine Reservoir was 168 feet. At a water level of 168 feet, the reservoir has 4 MG of storage remaining (15.2 MG below full).

## 5.2 Tank and Reservoir

### 5.2.1 Alternative Description

A plan of the proposed improvements to the Levine area is shown on Drawing No. 011 of Appendix A. The main improvements consist of:

- Two 2.5-MG tanks,
- A new access road,
- New piping to connect the tanks to existing reservoir inlet and outlet piping,
- Separating the remaining portion of the reservoir from the water distribution system, and
- Stormwater improvements.

Drawing No. 012 of Appendix A shows an enlarged plan view of the tanks and associated piping. Two 2.5-MG prestressed concrete tanks would be constructed within the reservoir footprint. Each tank would have a separate fill and drain pipeline, as well as interior baffling to enhance the water quality within the tanks. A pipeline connecting the two tanks would provide equalization, with a wash down hydrant connected to the line from the New Street Tanks.

A utility building would be provided next to the tanks to house water quality monitoring and other equipment. A UPS would be provided for all SCADA equipment. An access road around the tanks would connect to the existing reservoir access road on the site. New 48-inch piping would be installed to connect the tanks to the existing reservoir inlet and outlet piping.

To provide constructor sequencing, a portion of the reservoir is to remain. This reduced capacity reservoir would be isolated from the construction area with a concrete wall and be modified to maintain its connection to the water distribution system during construction. This allows storage for the 180 Gradient during construction. A temporary tee and valve would be installed on the reservoir inlet piping to facilitate filling and draining of the reservoir during construction. Existing chlorination equipment would need to temporarily be connected to this piping.

After the new tanks are constructed, the reservoir would be disconnected from the water distribution system and serve as a stormwater detention pond. A new hydrant would be installed near the pond for maintenance purposes. A new reservoir overflow pipeline will connect to existing stormwater piping nearby to protect the reservoir from overtopping. The concrete wall would remain in place and act as a retaining wall to minimize fill. More discussion on construction sequencing can be found in Section 6.

### 5.2.2 Design Criteria

Table 5 lists the design criteria for the new tanks.

**Table 5 Levine Tanks – Design Criteria**

| Element | Value |
|---|---|
| Diameter of Each Tank (ft) | 160 |
| Bottom Tank Elevation (ft) | 175 |
| Tank Overflow Elevation (ft) | 192 |
| Freeboard Above Overflow (ft) | 2 |
| Maximum Water Height (ft) | 17 |
| Tank Inside Height (ft) | 19 |
| Tank Storage Volume (MG) | 2.56 |
| Tank Storage Volume for Two Tanks (MG) | 5.11 |

### 5.2.3 Theory of Operation

The tanks would operate in much the same way as the reservoir was operated. However, the tanks will now have a separate inlet and outlet pipeline.

#### 5.2.4 Cost Opinion

The cost opinion to install the Levine improvements is $15,300,000. A detailed breakdown of the cost opinion for these improvements is located in Appendix B.

# 6.0 VERONA TANK

## 6.1 Background

The 673 Gradient includes approximately 18 percent of the total system demands. This gradient is also referred to as the Morris County/Verona Gradient. The 673 Gradient relies on the 2-MG Verona Tank for storage. PVWC owns the top half of the volume of the Verona Tank and uses it for providing equalization to the 673 Gradient. Due to reduced system reliability, an additional 2-MG elevated storage tank be provided adjacent to the existing tank. A UPS would be provided for all SCADA equipment.

## 6.2 Cost

The cost opinion to install the Verona Tank is $3,000,000. The cost opinion for these improvements is located in Appendix B.

# 7.0 STANDBY ENERGY GENERATORS

## 7.1 Existing Power System at LFWTP

#### 7.1.1 Utility Sources

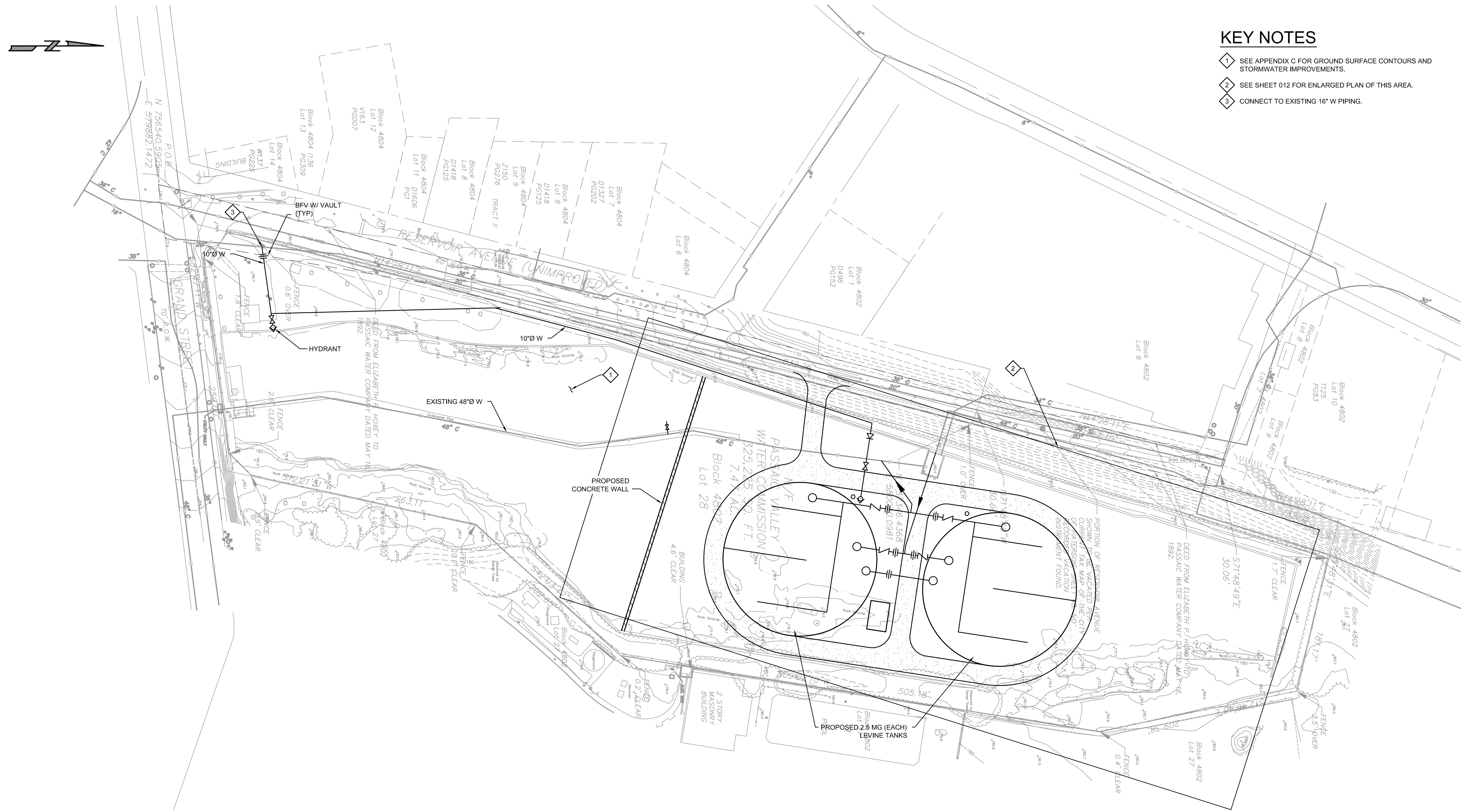
The existing power source for the LFWTP is from two PSE&G 26-kV circuits. One circuit enters the plant overhead from the South, crossing the Passaic River. The other circuit runs through the plant underground. PSE&G Automatic transfer equipment ahead of the LFWTP electric meter connects the plant to one circuit, and switches to the other if power is lost on the first.

#### 7.1.2 Substation and Transformers

An overhead 26-kV bus system distributes power to three transformers to step the voltage down to 2.4 kV for distribution and utilization within the plant. Each transformer is rated to deliver 7,500 kVA with natural cooling, or 9,375 kVA with forced-air from cooling fans. All three transformers have a delta-delta winding connection, which results in a secondary that does not have a ground reference. Two of the transformers connect to Switchgear A on either side of a tie breaker, and the third transformer connects to Switchgear MV. Switchgear A is outdated (increasing maintenance and replacement part difficulties) and is probably near the end of its useful life. For the purpose of this report, we have assumed replacement of this switchgear.

# KEY NOTES

1. SEE APPENDIX C FOR GROUND SURFACE CONTOURS AND STORMWATER IMPROVEMENTS.
2. SEE SHEET 012 FOR ENLARGED PLAN OF THIS AREA.
3. CONNECT TO EXISTING 16" W PIPING.




A LEVINE RESERVOIR SITE PLAN

SCALE: 1"=50'

FILE:

| REV | DATE | BY | DESCRIPTION |
|---|---|---|---|
| | | | |

DESIGNED

DRAWN

CHECKED

DATE

DISCIPLINE ENGINEER

PROJECT ENGINEER

PARTNER

carollo

PASSAIC VALLEY WATER COMM.

PASSAIC VALLEY WATER COMMISSION

WATER STORAGE IMPROVEMENTS CONCEPTUAL DESIGN

LEVINE RESERVOIR
SITE PLAN

VERIFY SCALES

BAR IS ONE INCH ON ORIGINAL DRAWING

0 1"

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

JOB NO. 8378A.00

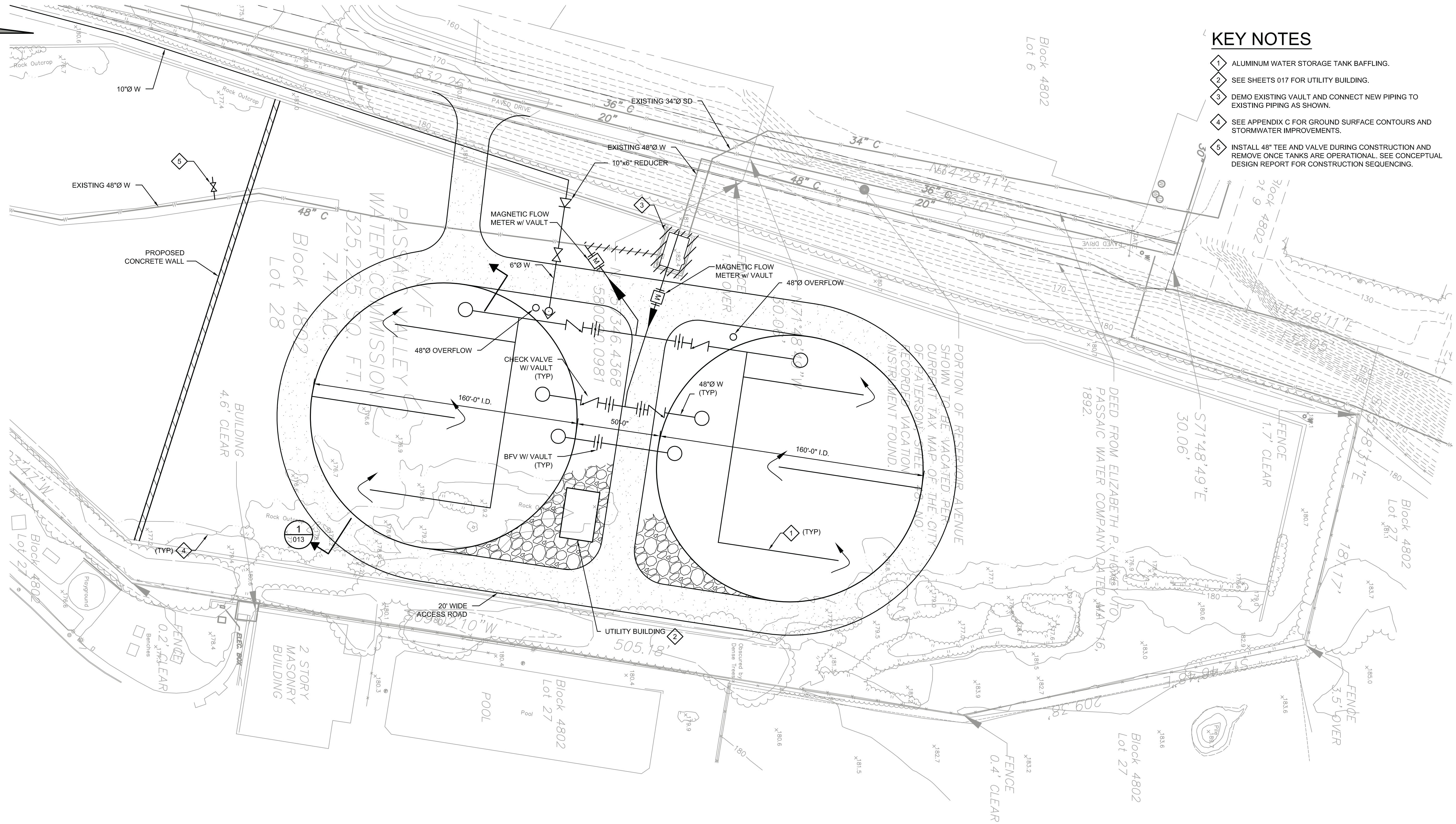
DRAWING NO. 011

SHEET NO. OF XXX

PROJECT NO: 8378A00 FILENAME: 8378A00-011.dwg PLOT TIME: $TIME$

LAST SAVED BY: tlockwood

LAST UPDATED: [illegible]




## KEY NOTES

1. ALUMINUM WATER STORAGE TANK BAFFLING.
2. SEE SHEETS 017 FOR UTILITY BUILDING.
3. DEMO EXISTING VAULT AND CONNECT NEW PIPING TO EXISTING PIPING AS SHOWN.
4. SEE APPENDIX C FOR GROUND SURFACE CONTOURS AND STORMWATER IMPROVEMENTS.
5. INSTALL 48" TEE AND VALVE DURING CONSTRUCTION AND REMOVE ONCE TANKS ARE OPERATIONAL. SEE CONCEPTUAL DESIGN REPORT FOR CONSTRUCTION SEQUENCING.

## A LEVINE RESERVOIR SITE PLAN

SCALE: 1"=30'
FILE:

| REV | DATE | BY | DESCRIPTION |
|---|---|---|---|

DESIGNED
DRAWN
CHECKED
DATE
DISCIPLINE ENGINEER
PROJECT ENGINEER
PARTNER

carollo

PASSAIC VALLEY WATER COMM.

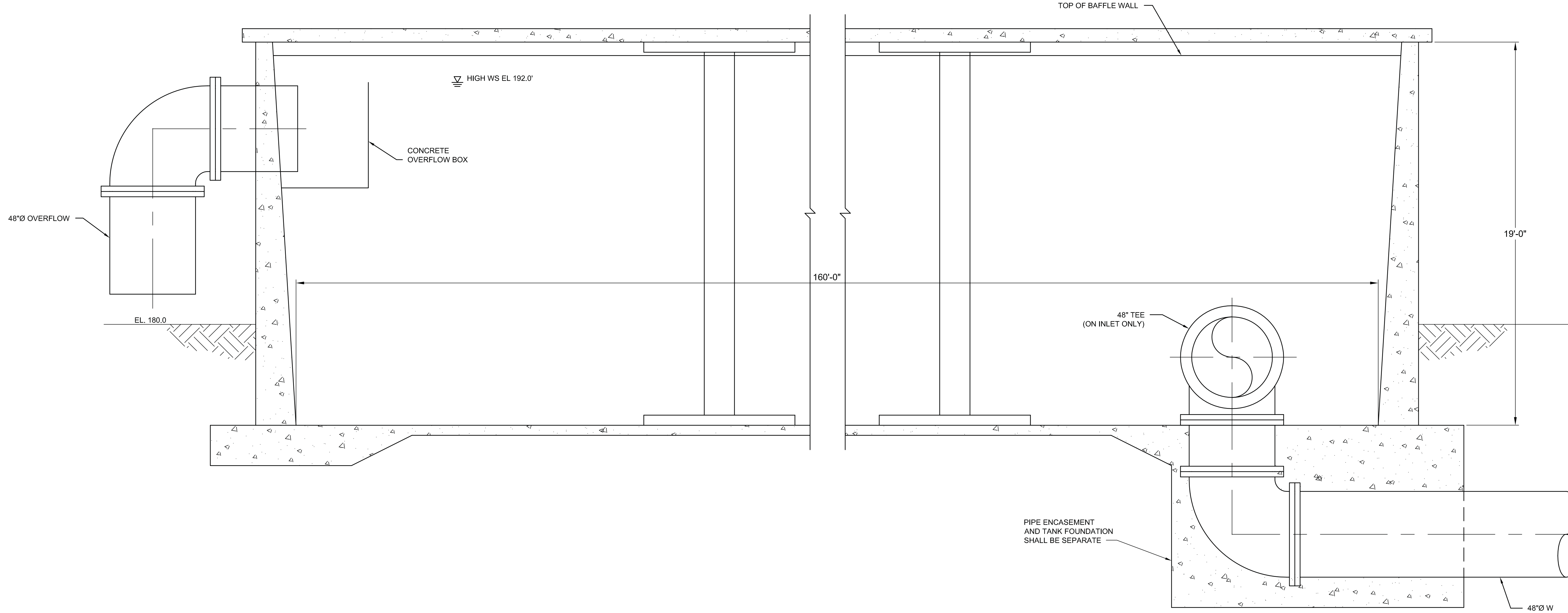
PASSAIC VALLEY WATER COMMISSION
WATER STORAGE IMPROVEMENTS CONCEPTUAL DESIGN
LEVINE RESERVOIR
ENLARGED SITE PLAN

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

JOB NO. 8378A.00
DRAWING NO. 012
SHEET NO. OF XXX

PROJECT NO: 8378A00 FILENAME: 8378A00-012.dwg PLOT TIME: $TIME$

LAST SAVED BY: jkeistler




1 / 012 LEVINE TANKS SECTION
SCALE: 3/8"=1'-0"
FILE: 8378A00-C-006

| REV | DATE | BY | DESCRIPTION | DESIGNED / DRAWN / CHECKED / DATE | DISCIPLINE ENGINEER | PROJECT ENGINEER | PARTNER |
|---|---|---|---|---|---|---|---|

carollo

PASSAIC VALLEY WATER COMM.

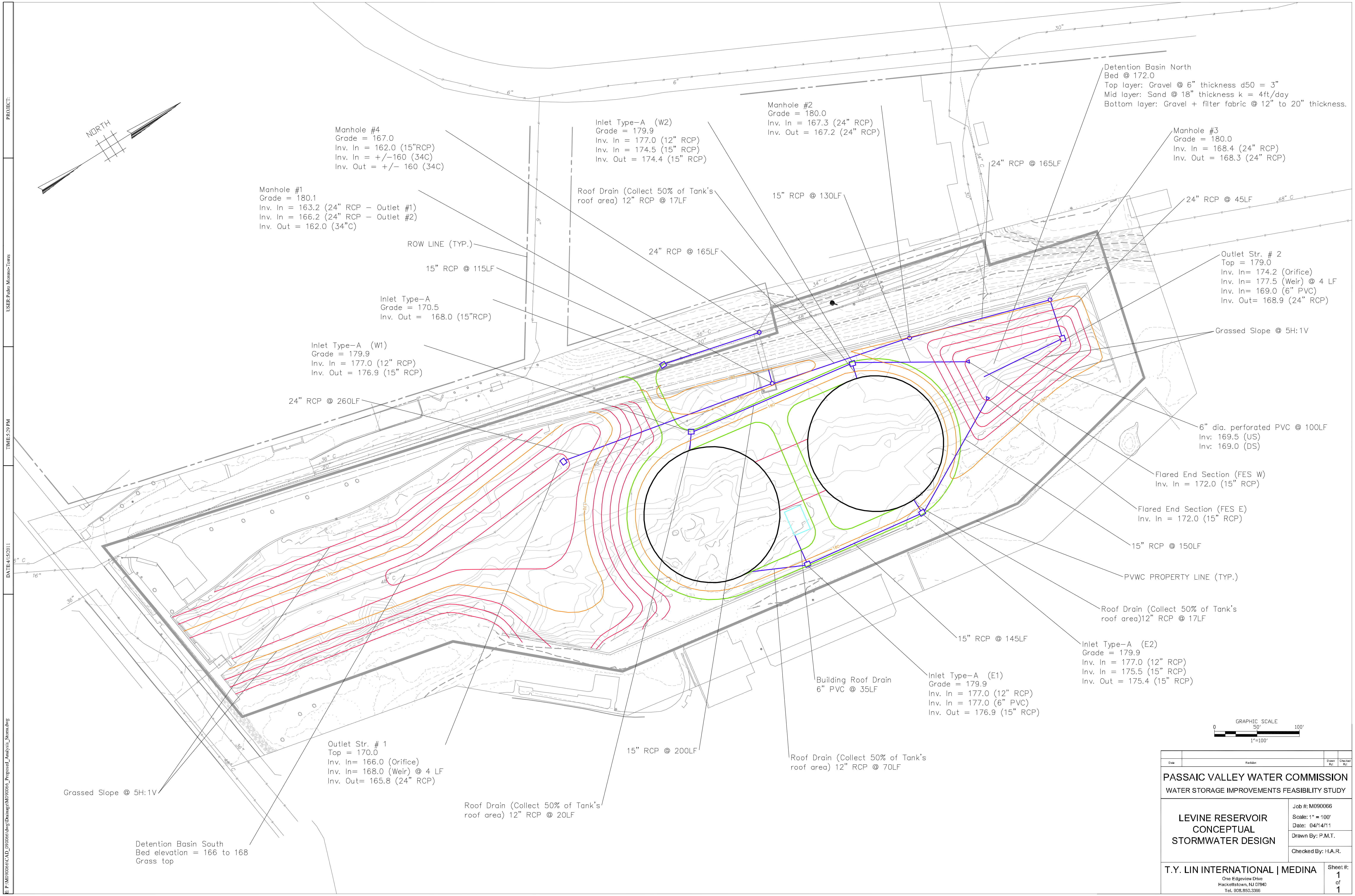
PASSAIC VALLEY WATER COMMISSION
WATER STORAGE IMPROVEMENTS CONCEPTUAL DESIGN
LEVINE
TANKS SECTION

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

JOB NO. 8378A.00
DRAWING NO. 013
SHEET NO. OF XXX

PROJECT NO: 8378A00 FILENAME: 8378A00-013.dwg PLOT TIME: $TIME$

LAST SAVED BY: tlockwood
LAST UPDATED:




PROJECT:
USER:Pedro Moreno-Torres
TIME:5:29 PM
DATE:4/15/2011
E: P:\M090066\CAD_090066\dwg\Drainage\M090066_Proposed_Analysis_Storm.dwg

| Date | Revision | Drawn By: | Checked By: |
|---|---|---|---|
| | | | |

PASSAIC VALLEY WATER COMMISSION
WATER STORAGE IMPROVEMENTS FEASIBILITY STUDY

LEVINE RESERVOIR
CONCEPTUAL
STORMWATER DESIGN

Job #: M090066
Scale: 1" = 100'
Date: 04/14/11
Drawn By: P.M.T.
Checked By: H.A.R.

T.Y. LIN INTERNATIONAL | MEDINA
One Edgeview Drive
Hackettstown, NJ 07840
Tel. 908.850.3366

Sheet #: 1 of 1