Water Storage Improvements Phase 1
Levine Water Tanks

Alternative Site Evaluation

Prepared for

Passaic Valley Water Commission

August 2014

CH2MHILL®

Hatch Mott MacDonald

Contents

Figures

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Acronyms and Abbreviations

AACO	Amended Administrative Consent Order
ACO	Administrative Consent Order
CLDIP	cement lined ductile iron pipe
CY	cubic yards
GIS	Geographic Information System
HDPE	high density polyethylene
LF	Linear feet
LFWTP	Little Falls Water Treatment Plant
MG	million gallons
MGD	million gallons per day
m/s	meters per second
NJAC	New Jersey Administrative Code
NJDEP	New Jersey Department of Environmental Protection
NJEIT	New Jersey Environmental Infrastructure Trust
NJSR	New Jersey Register of Historic Places
PVC	polyvinyl chloride
PVWC	Passaic Valley Water Commission
SCADA	Supervisory Control and Data Acquisition
SHPO	New Jersey State Historic Preservation Office

SECTION 1

Introduction

1.1 Project Overview

CH2M HILL has been engaged by Passaic Valley Water Commission (PVWC), under Project 12-P-43, to provide professional engineering services for the Emergency Back-up Power and Water Storage Facilities Project. Hatch Mott MacDonald, under subcontract to CH2M HILL, is also providing some of the engineering services for the project.

One of three sub-projects in Project 12-P-43 is the replacement of the existing Levine Reservoir with new covered tanks. The general proposed scope of the Levine Tanks project was presented in the April 2011 "Water Storage Improvements - Final Conceptual Design Report" prepared for PVWC by Carollo Engineers. PVWC has agreed with NJDEP to implement the Levine Tanks project, generally in accordance with the Final Conceptual Design Report, pursuant to Amended Administrative Consent Order No. NEA08001-1605002 (ACO).

The basic parameters of the project, as defined in the Final Conceptual Design Report, include the construction of two tanks, each of the following characteristics:

- Type pre-stressed concrete
- Nominal Capacity 2.5 MG
- Floor elevation 175
- Overflow elevation 193
- High Water Level 192
- Inside Diameter 156 ft.

The Conceptual Design called for the tanks to be built within the area presently occupied by the existing reservoir, and therefore a critical issue in the project implementation is the maintenance of water system operations during construction. The Conceptual Design Report proposed a dividing wall which would allow part of the existing reservoir to remain in service during construction of the tanks.

Another key issue identified in the Conceptual Design Report was stormwater management. Much of the site that will not be occupied by the two new tanks was to be devoted to two proposed stormwater detention basins.

The Conceptual Design also included a utility building for chemical feed, water quality monitoring equipment and SCADA equipment.

The Levine Reservoir lies within the Great Falls of Paterson Historic District and is listed in the State Registry of Historic Places. Removing the reservoir will be considered an encroachment to the Historic site and require an application and cultural resources survey to be filed with the State Historic Preservation Office (SHPO).

Pursuant to the revised Amended Administrative Consent Order issued June 24, 2014 by NJDEP, PVWC has authorized CH2M HILL and Hatch Mott MacDonald to conduct an Alternative Site Evaluation to determine whether construction of the Levine Reservoir tanks at another location would be feasible. Three sites have been identified for evaluation:

Site 1: Block 5103 Lot 24, Paterson (former quarry on New Street)

Site 2: Block 5107 Lot 1, Paterson (across New Street from Site 1)

Site 3: Block 801, Lots 21 and 22, Paterson (formerly The Vistas at Great Falls)

The general location of these sites is shown on Figure 1-1.

1.2 Scope of Report

The objective of the evaluation is to assess on a conceptual level the feasibility of each site as a potential alternative location for the construction of water storage tanks currently proposed to be located at the existing Levine Reservoir site. The scope of the evaluation includes:

- Evaluate technical feasibility of each site considering system hydraulics;
- Evaluate environmental and land use concerns for each site;
- Compare permitting requirements for alternative sites to those at the Levine site;
- Perform a geotechnical review of the proposed site and off-site piping alignments;
- Develop conceptual plans for disconnecting the existing reservoir and preventing stagnation if it remains an open water body;
- Prepare cost estimates for construction at each site for comparison to estimated construction cost for the current project; and
- Estimate impact to current project schedule to evaluate alternative sites, acquire alternative sites and re-design project for alternate site.

Figure 1-1: Overall Location Plan

NO.	DATE	REVISION	DR	CHK	APVD	BY	APVD
DSGN							

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CLIFTON, NEW JERSEY

LEVINE WATER TANKS

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ALTRNATE SITE LOCATIONS OVERVIEW

VERIFY SCALE

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SECTION 2

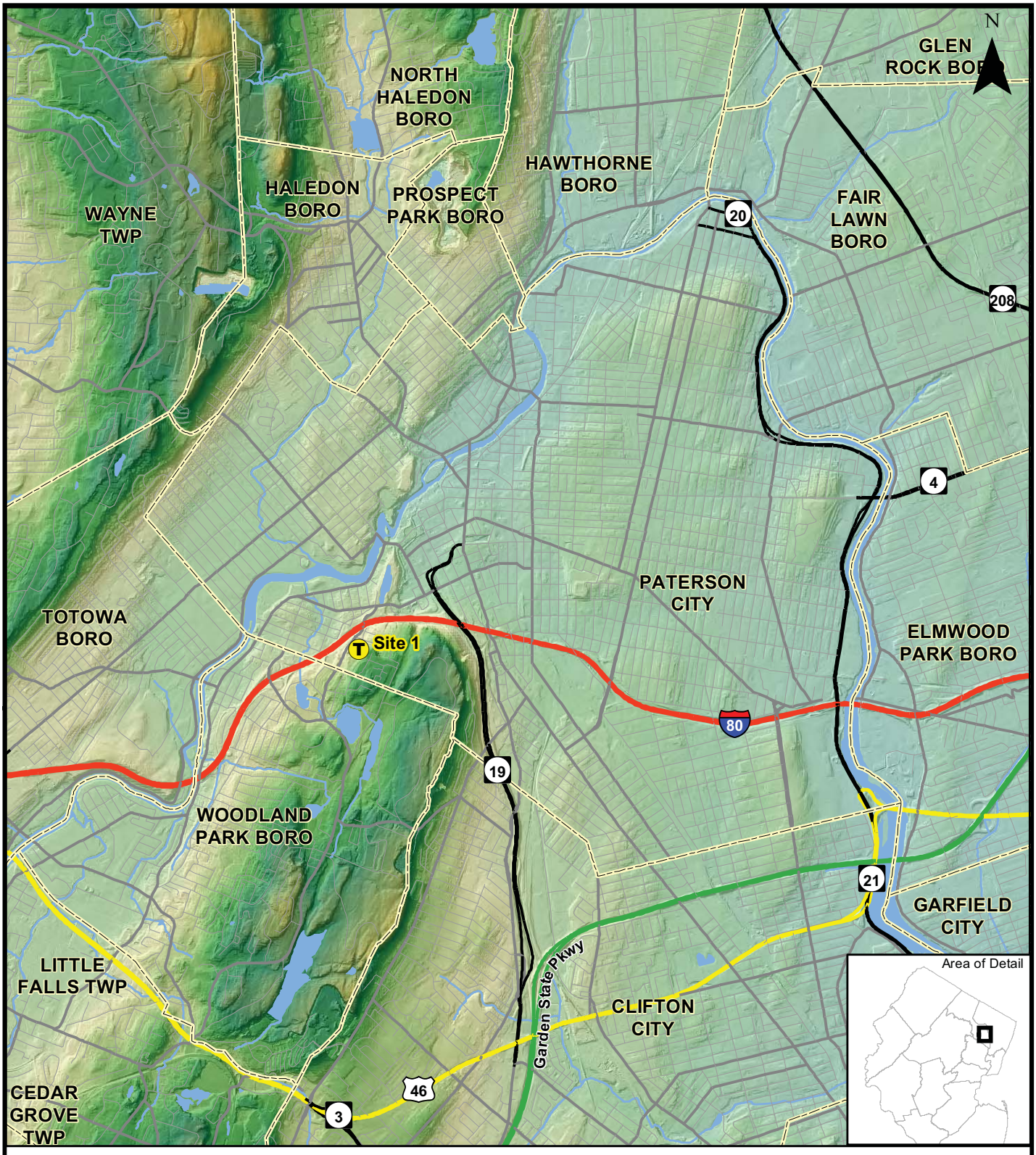
Technical Feasibility

2.2 Evaluation Criteria

Each site was evaluated as to whether its size, shape and topography would be suitable for construction of the tanks, chlorination station, piping, grading and stormwater management. Each site was also reviewed for general compatibility with existing system, including the site elevation relative to the system hydraulic gradeline, and proximity to major transmission mains. Additional considerations for the site evaluation included options for tank overflow discharge, and alignments of off-site tank inlet and outlet water mains. Publicly available information was reviewed to determine potential constraints of site geology, soils, environmental features, land use, and proximity to historic districts.

2.3 Site Descriptions

Location maps for each site are presented as Figures 2-1, 2-2 and 2-3. Project areas for detailed evaluation, including the area within a ¼ mile radius of each site, were delineated as shown on Figures 2-4, 2-5 and 2-6. A description of each site, based upon site inspections and publicly available information, is presented below. Conceptual site plans for tank construction at each tank are shown on Figures 2-7, 2-8, and 2-9. The environmental, geotechnical and other characteristics of each site are described further later in the report. The sites were initially evaluated as to whether there would be sufficient space to construct the tanks, chemical feed/utility building, access roads and a stormwater management system. For evaluation of the feasibility of constructing stormwater management in compliance with published standards, it was estimated that a 1-acre detention basin could be configured to meet water quantity criteria at N.J.A.C. 7:8. It was assumed that a bioretention system would also be needed to treat access road runoff for total suspended solids removal.



LEGEND

- Site 1: Block 5103 Lot 24 (former quarry on New Street)
- Municipal Boundary
- Lakes & Ponds
- Rivers & Streams

Basemap: National Elevation Dataset DEM and Hillshade

New Jersey Roads

- Interstate
- US Highway
- State Highway
- Toll Road
- County Road
- Local Road

Site located within the Lower Passaic and Saddle River Watershed Management Area.

Regional air quality characteristics are provided in a separate table.

0 0.375 0.75 1.5 Miles

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Iselin, New Jersey

PASSAIC VALLEY WATER COMMISSION
LEVINE TANK SITE 1
PASSAIC COUNTY, NEW JERSEY

Figure 2-1: Site 1 Location Map

Designed	Drawn	Checked	Approved	Date
JMF	JMF			7/11/2014

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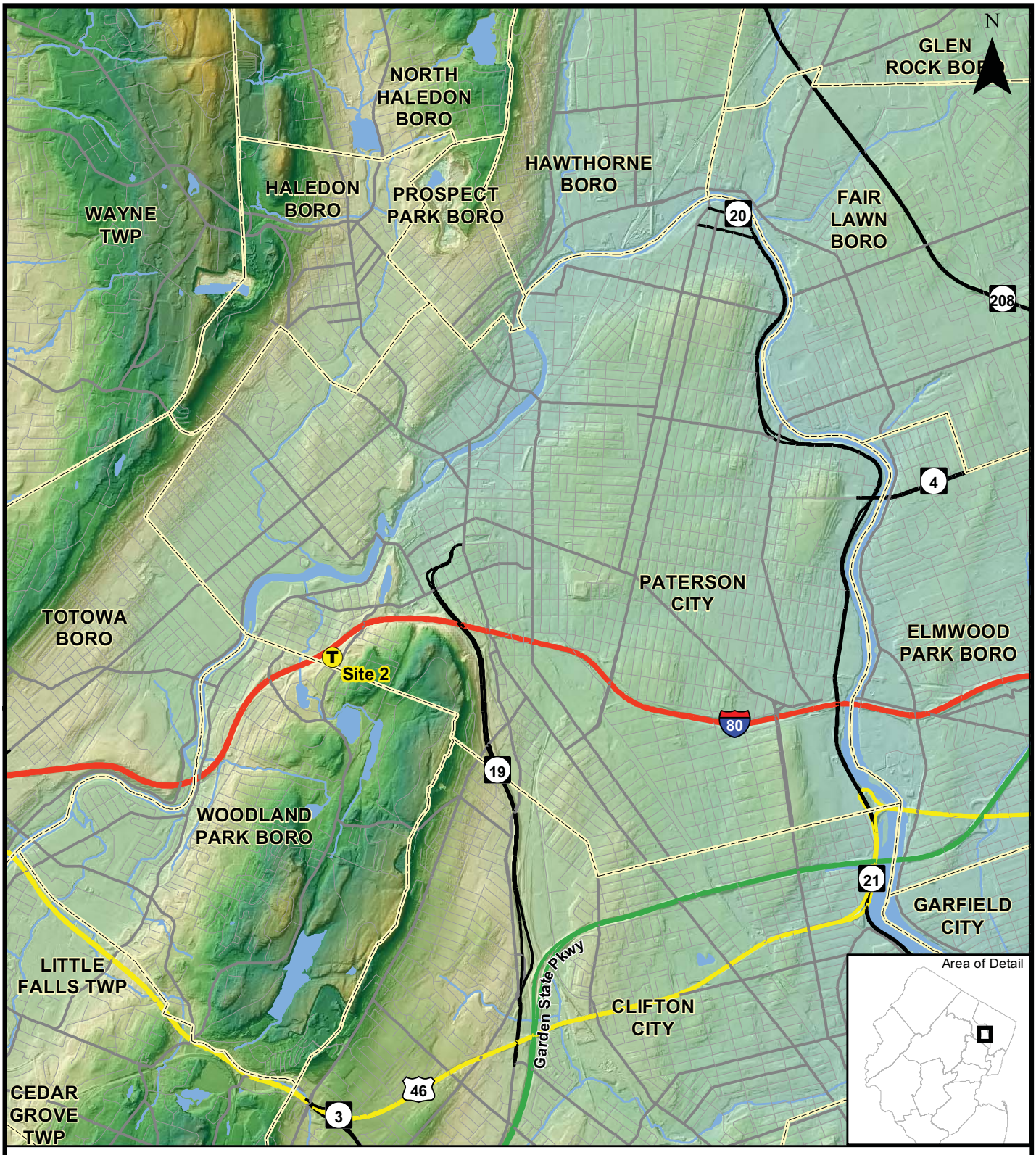

LEGEND

- Site 2: Block 5107 Lot 1 (New Street, across from Site 1)
- Municipal Boundary
- Lakes & Ponds
- Rivers & Streams

Basemap: National Elevation Dataset DEM and Hillshade

New Jersey Roads

- Interstate
- US Highway
- State Highway
- Toll Road
- County Road
- Local Road

Site located within the Lower Passaic and Saddle River Watershed Management Area.

Regional air quality characteristics are provided in a separate table.

0 0.375 0.75 1.5 Miles

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LEVINE TANK SITE 2
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Figure 2-2: Site 2 Location Map

Designed	Drawn	Checked	Approved	Date
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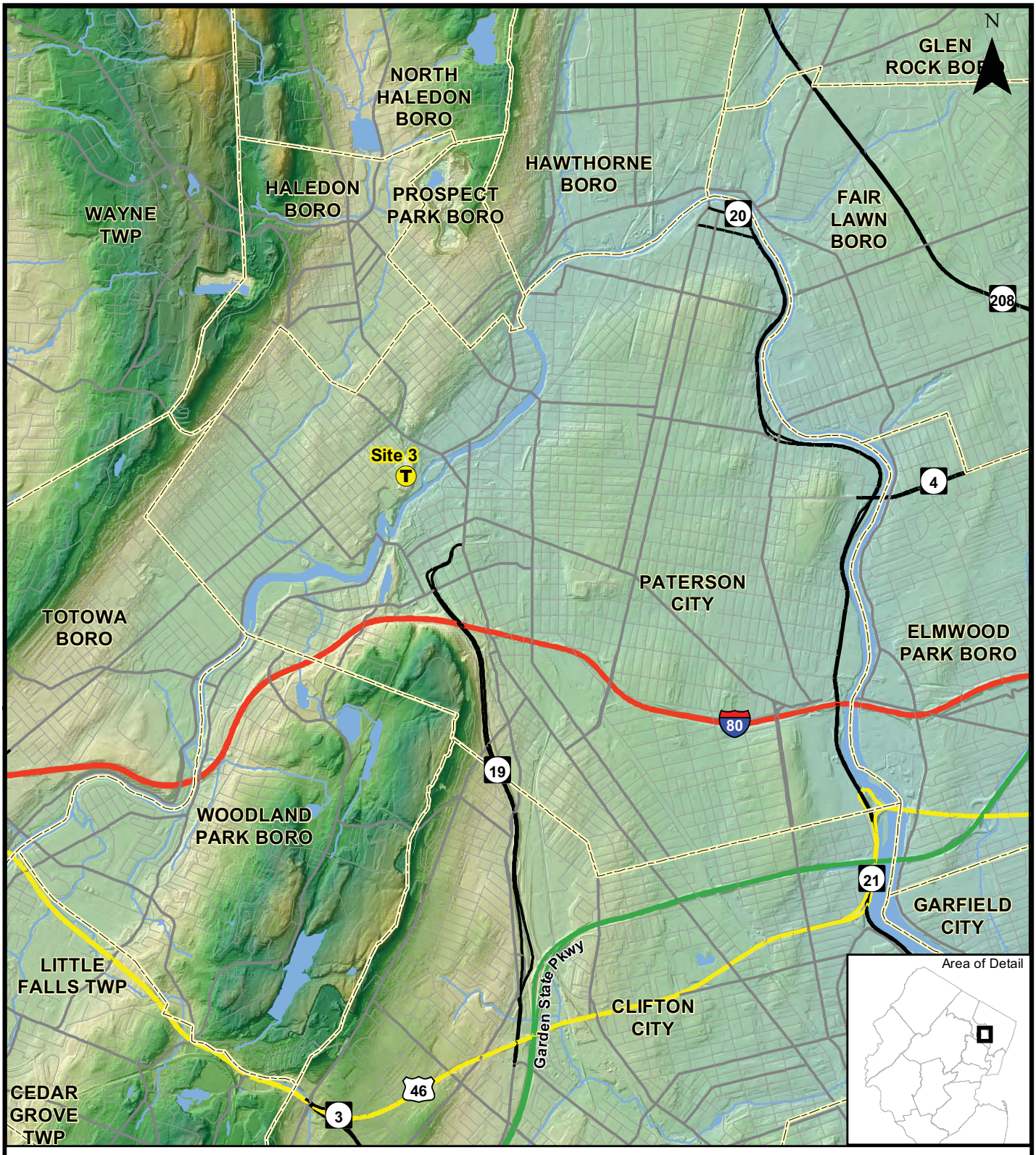

LEGEND

- T Site 3: Block 801, Lots 21 & 22 (The Vistas at Great Falls)
- Municipal Boundary
- Lakes & Ponds
- Rivers & Streams

Basemap: National Elevation Dataset DEM and Hillshade

Site located within the Lower Passaic and Saddle River Watershed Management Area.

Regional air quality characteristics are provided in a separate table.

New Jersey Roads

- Interstate
- US Highway
- State Highway
- Toll Road
- County Road
- Local Road

0 0.375 0.75 1.5 Miles

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PASSAIC VALLEY WATER COMMISSION
LEVINE TANK SITE 3
PASSAIC COUNTY, NEW JERSEY

Figure 2-3: Site 3 Location Map

Designed	Drawn	Checked	Approved	Date
JMF	JMF			7/11/2014

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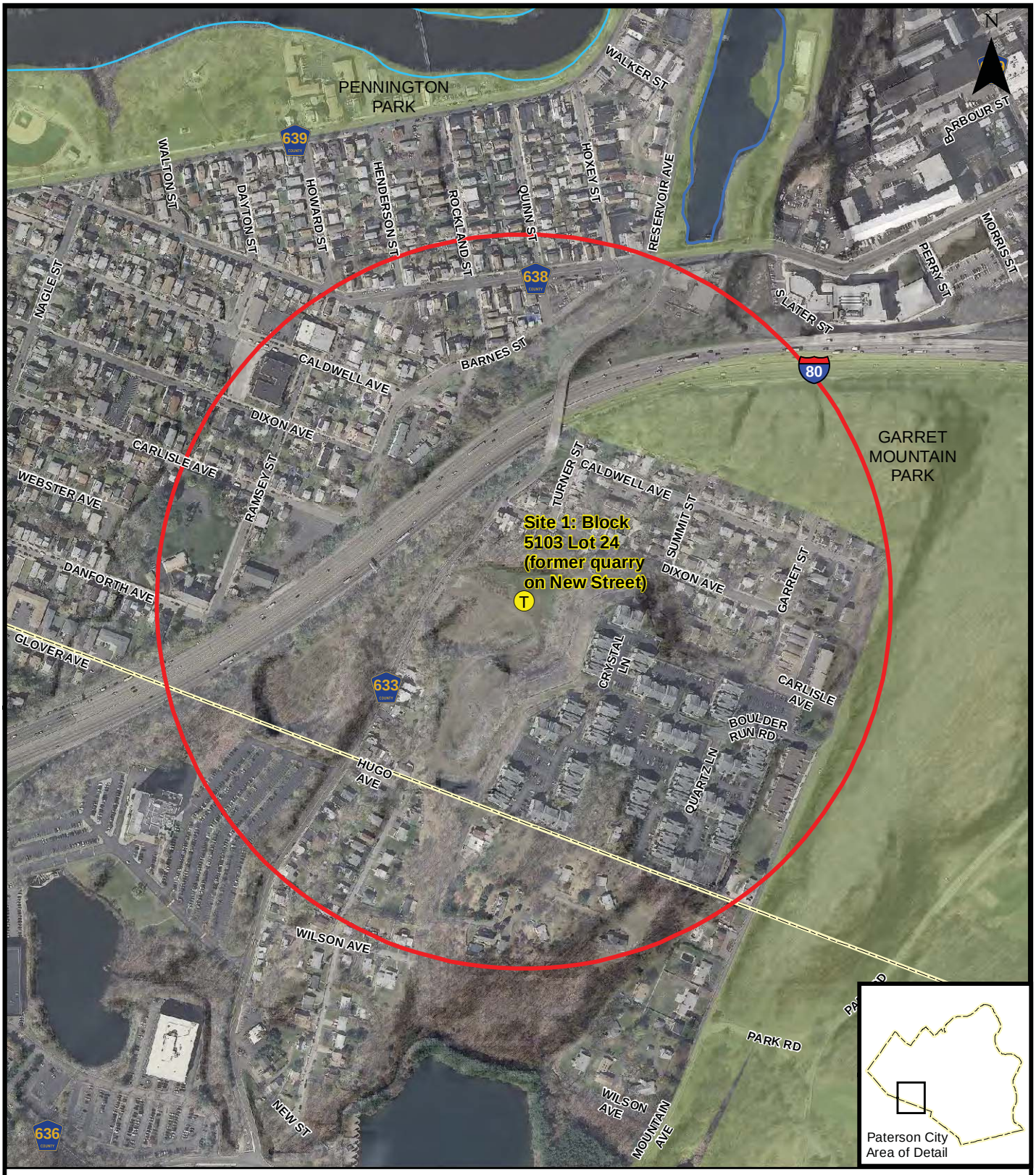

LEGEND

- Proposed Tank Site 1
- Project Area
- Stanley Levine Reservoir
- Passaic River
- Municipal Boundary
- State or Local Park

Basemap: 2012 MrSID Orthophotography Tiles and National Elevation Dataset Hillshade

No Public Community Supply Wells or Well Head Protection Areas identified in data provided by NJDEP

0 250 500 1,000 Feet

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PASSAIC VALLEY WATER COMMISSION
LEVINE TANK SITE 1
PATERSON, NEW JERSEY

Figure 2-4: Site 1 Project Area

Designed	Drawn	Checked	Approved	Date
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LEGEND

- Proposed Tank Site 2
- Project Area
- Stanley Levine Reservoir
- Municipal Boundary
- National Park (Approximate Area)
- State or Local Park

No Public Community Supply Wells, Well Head Protection Areas, or major withdrawals identified in data provided by NJDEP

Basemap: 2012 MrSID Orthophotography Tiles and National Elevation Dataset Hillshade

0 250 500 1,000 Feet

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PASSAIC VALLEY WATER COMMISSION
LEVINE TANK SITE 2
PATERSON, NEW JERSEY

Figure 2-5: Site 2 Project Area

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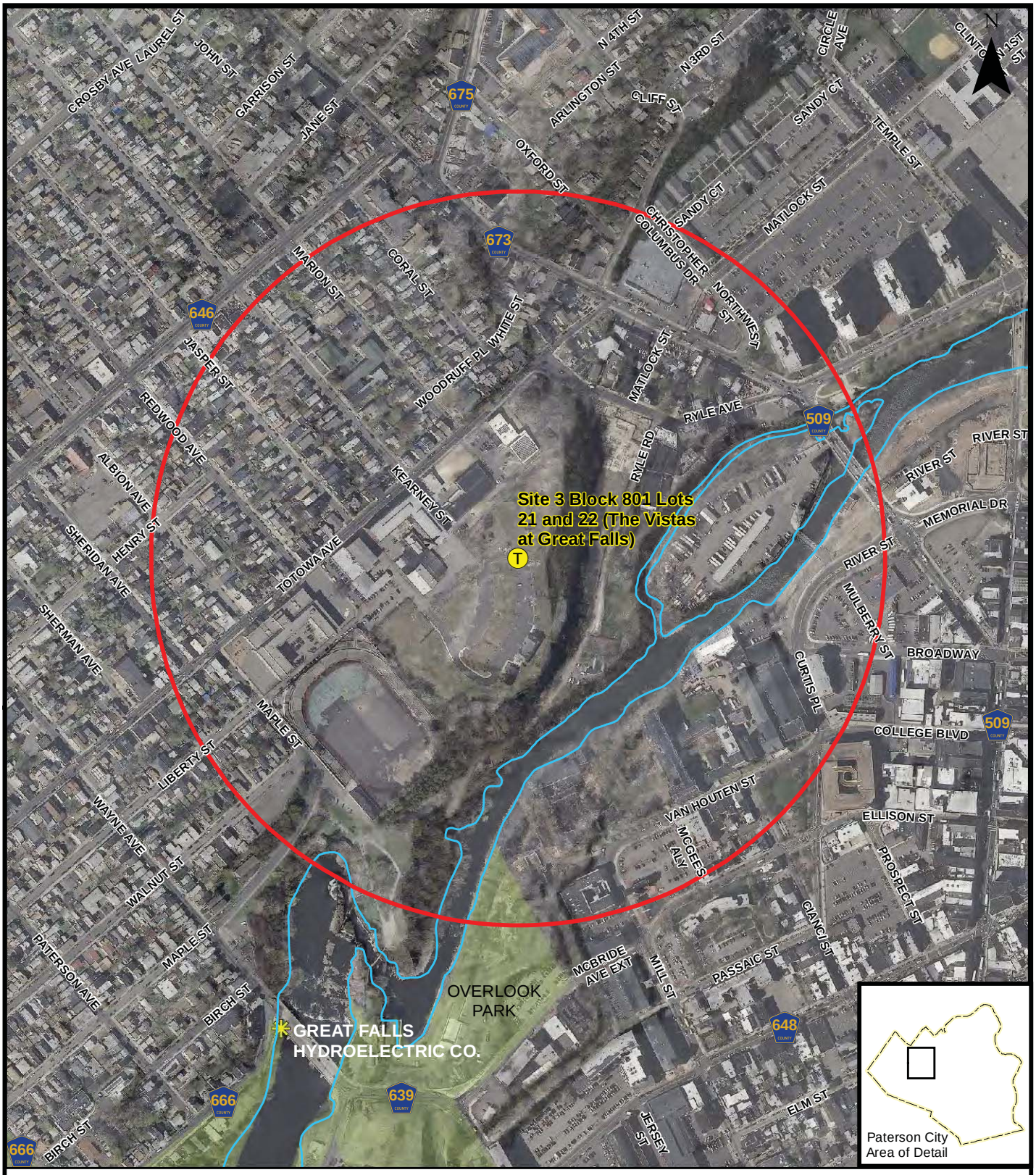

LEGEND

- Proposed Tank Site 3
- Project Area
- Passaic River
- Municipal Boundary
- National Park (Approximate Area)
- State or Local Park
- Major Withdrawals

No Public Community Supply Wells or Well Head Protection Areas identified in data provided by NJDEP

0 250 500 1,000 Feet

Basemap: 2012 MrSID Orthophotography Tiles and National Elevation Dataset Hillshade

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PASSAIC VALLEY WATER COMMISSION
LEVINE TANK SITE 3
PATERSON, NEW JERSEY

Figure 2-6: Site 3 Project Area

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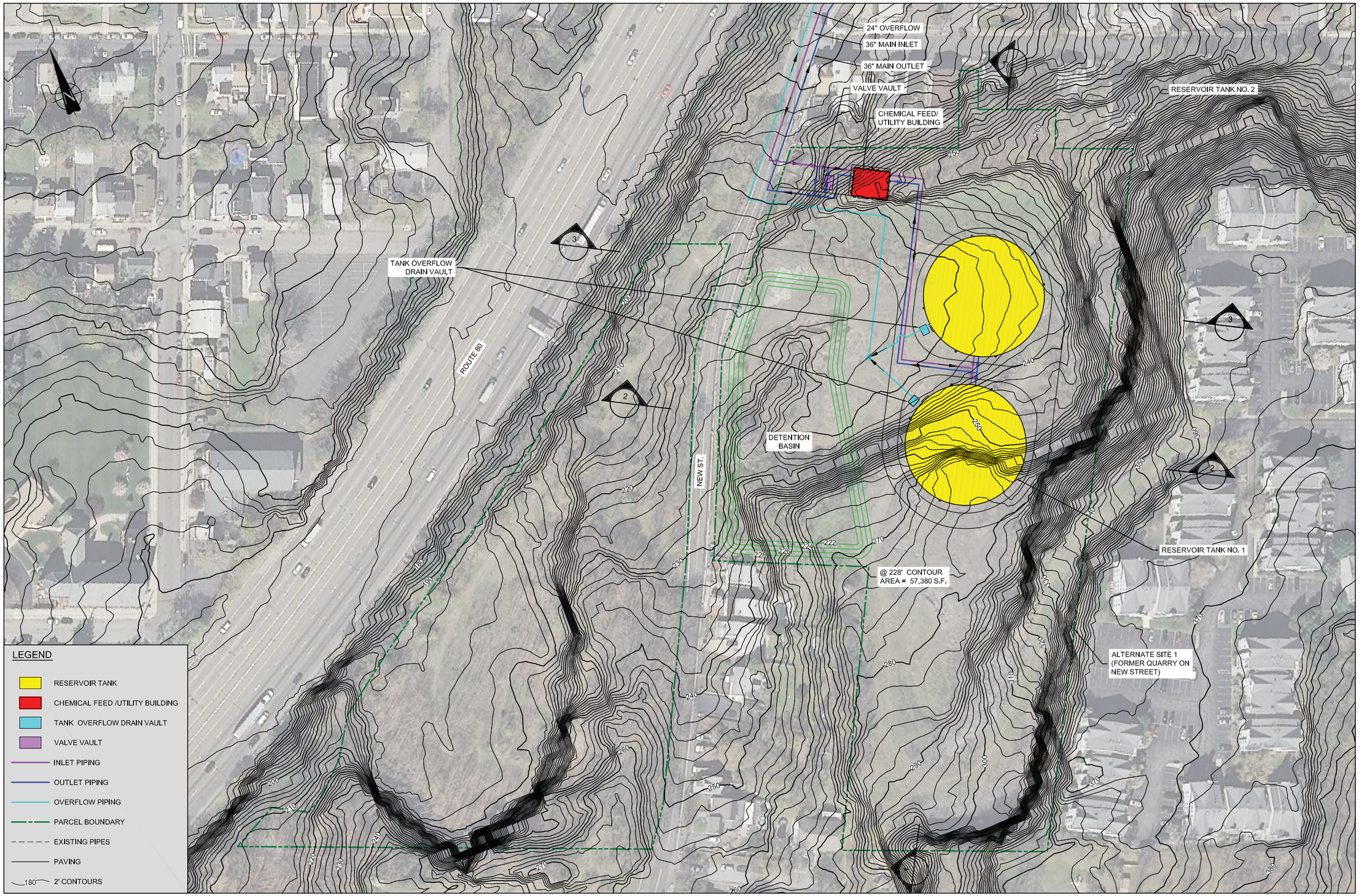

Figure 2-7: Site 1 Conceptual Site Plan

NO.	DATE	REVISION	DR	CHK	APVD	BY	APVD
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CLIFTON, NEW JERSEY

LEVINE WATER TANKS

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ALTERNATE SITE 1
(FORMER QUARRY ON NEW STREET)
ENLARGED PLAN

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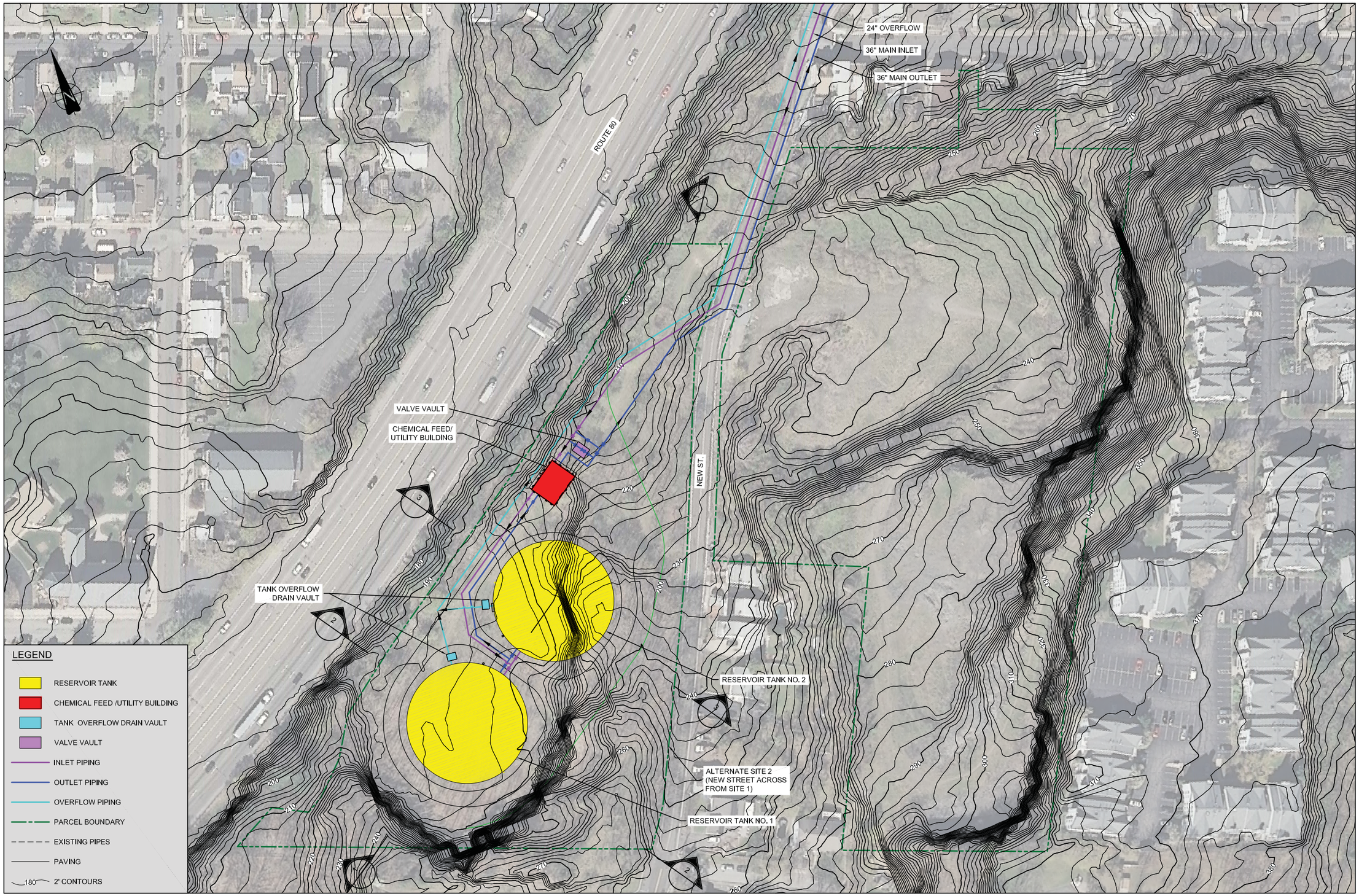

Figure 2-8: Site 2 Conceptual Site Plan

NO.	DATE	REVISION	DR	CHK	APVD	BY	APVD
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(NEW STREET ACROSS FROM SITE 1)
ENLARGED PLAN

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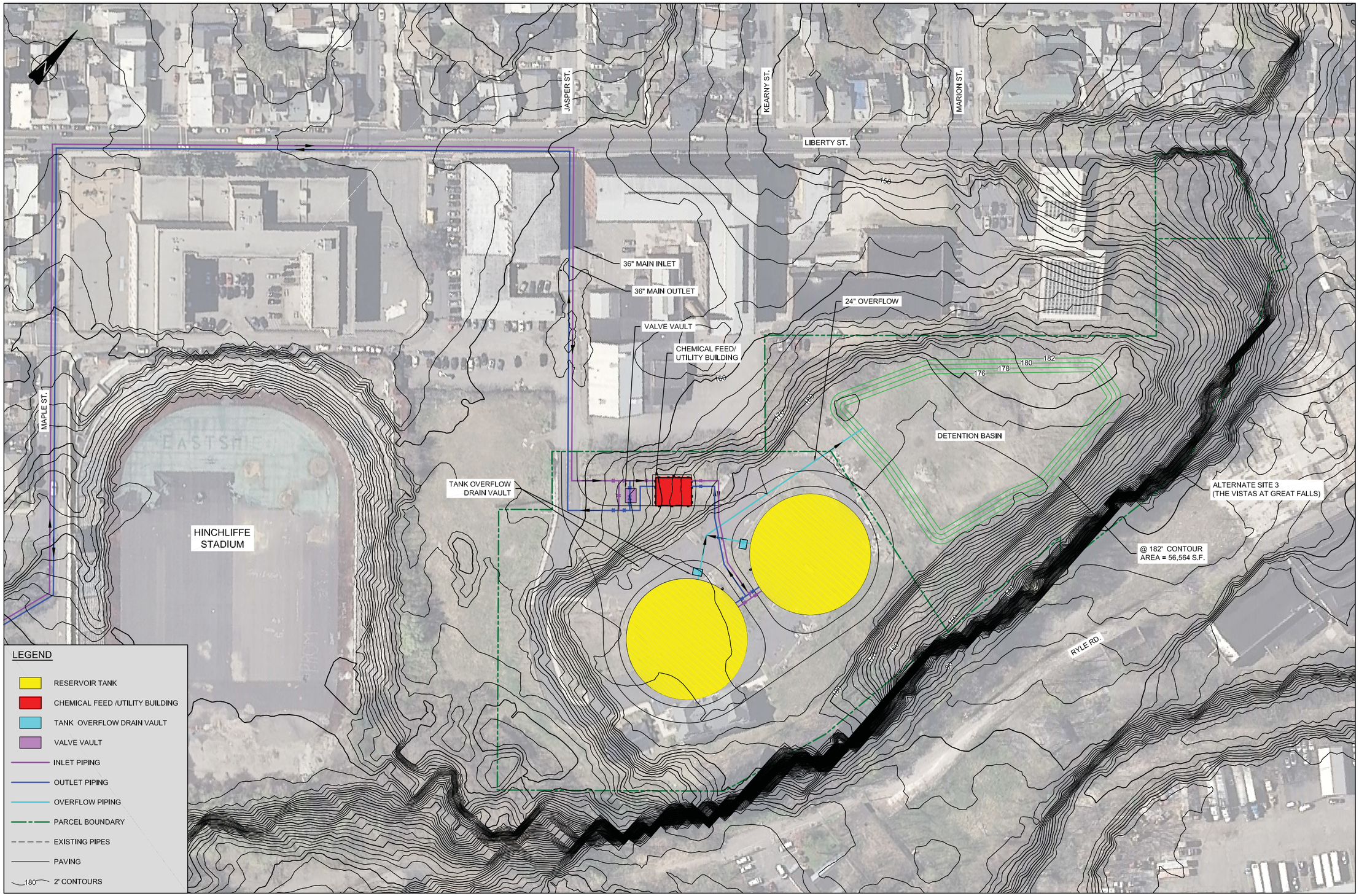

Figure 2-9: Site 3 Conceptual Site Plan

NO.	DATE	REVISION	DR	CHK	APVD	BY	APVD
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WATER COMMISSION
CLIFTON, NEW JERSEY

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ALTERNATE SITE 3
(THE VISTAS AT GREAT FALLS)
ENLARGED PLAN

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Site 1

Site 1 was reportedly formerly used as a quarry. The land adjacent to the quarry pit has an elevation of approximately 280 feet. The majority of the level portion of the site area is at an elevation of approximately 230 feet, sloping up to 250 feet to the north and up to 350 feet towards the east. Based upon the conceptual site plan, there appears to be sufficient area for construction of the tanks, chlorination building, access road and stormwater detention and bioretention based on facility footprints alone. However, significant excavation, most likely in rock, would be required. Furthermore, the extreme variations in site elevations, poor drainage conditions observed on site, and severe space constraints may preclude the construction of a viable stormwater management system at this location.

Site 2

Site 2 is across New Street and downhill from Site 1. The site has a relatively open and flat area to the southwest at an approximate elevation of 197 feet. The site drops off sharply towards Route 80 to the west, and narrows as it slopes up towards New Street to the north. To the east, the site elevation increases sharply by approximately 40 feet. Significant excavation of this slope would be necessary to accommodate both tanks, which has the potential to impact the stability of the incline and New Street above it. Furthermore, based upon the conceptual site plan, there is not sufficient space on site to construct the necessary stormwater treatment and detention facilities.

Site 3

Site 3 is the former location of several warehouses, and more recently the Vistas at Great Falls condominium development. Historical records indicate that the early PVWC system included several reservoirs on and near this site: the Lower Reservoir (now the site of Hinchliffe Stadium), Middle Reservoir and Upper or Totowa Reservoir. All structures have been demolished and only the foundations and paved parking areas of the Vistas development remain. The majority of the site is level with a cliff dropping off to the Valley of the Rocks to the east. The existing grade is approximately 186 feet. Based upon the conceptual site plan, the available space onsite appears to be adequate for the tanks, building, access road and stormwater facilities. There is no means for direct discharge of tank overflow to the river at this site, but the stormwater detention basin can accommodate a design overflow of 20 MGD for a short period of time.

2.4 System Hydraulics

Figures 2-10, 2-11, 2-12 and 2-13 present schematics of the existing PVWC Industrial Gradient system, and how it would be modified for the alternatives considered.

Figure 2-10 – Existing Industrial Gradient

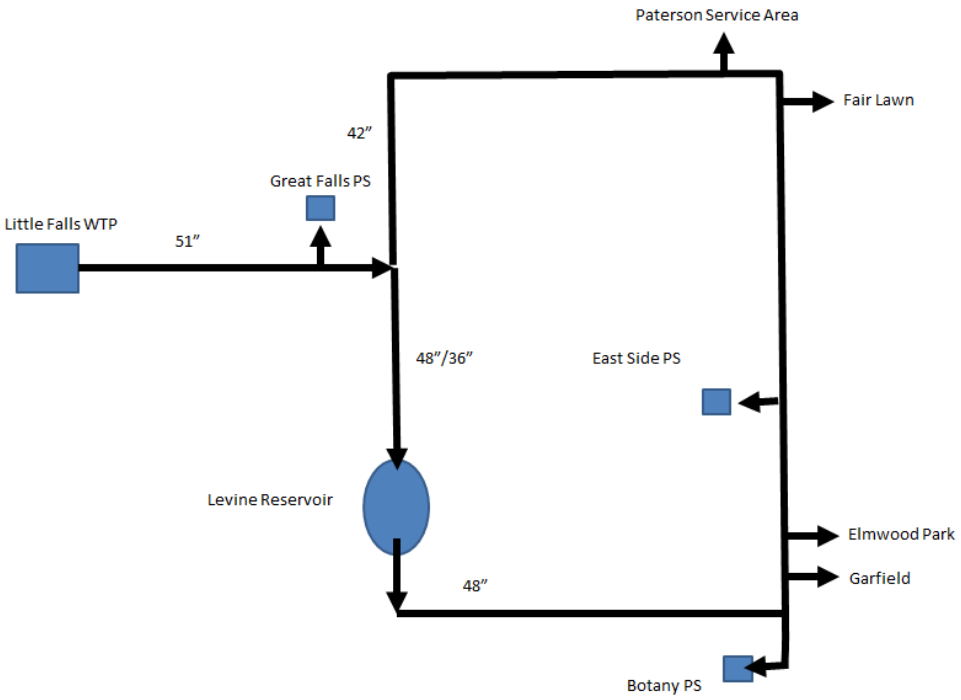


Figure 2-11 – Industrial Gradient with Tanks at Levine Site

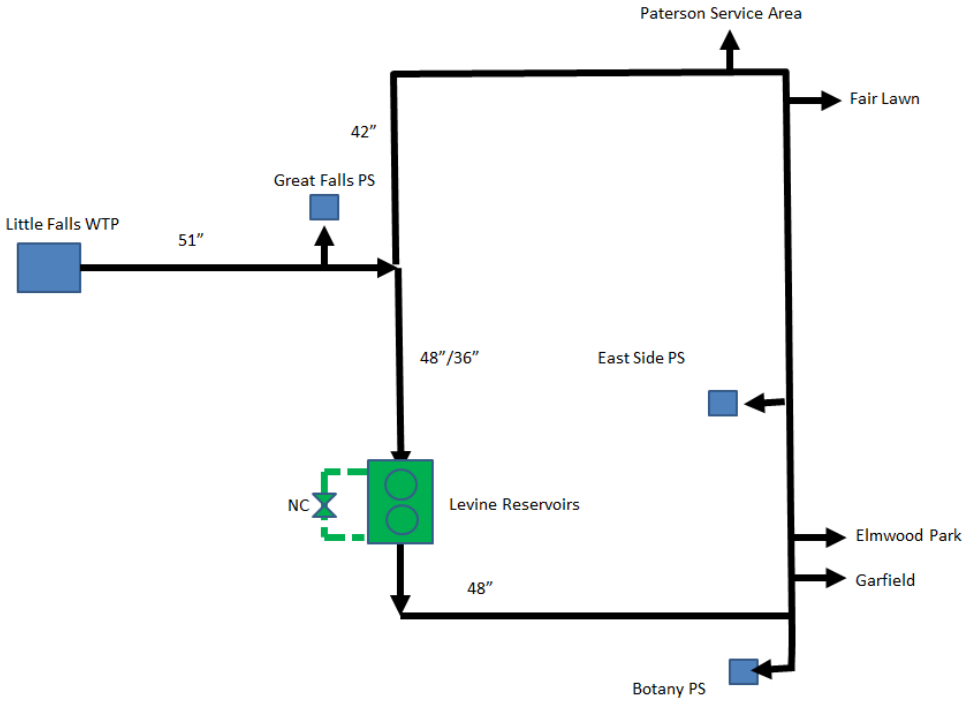


Figure 2-12 – Industrial Gradient with Tanks at Sites 1 or 2

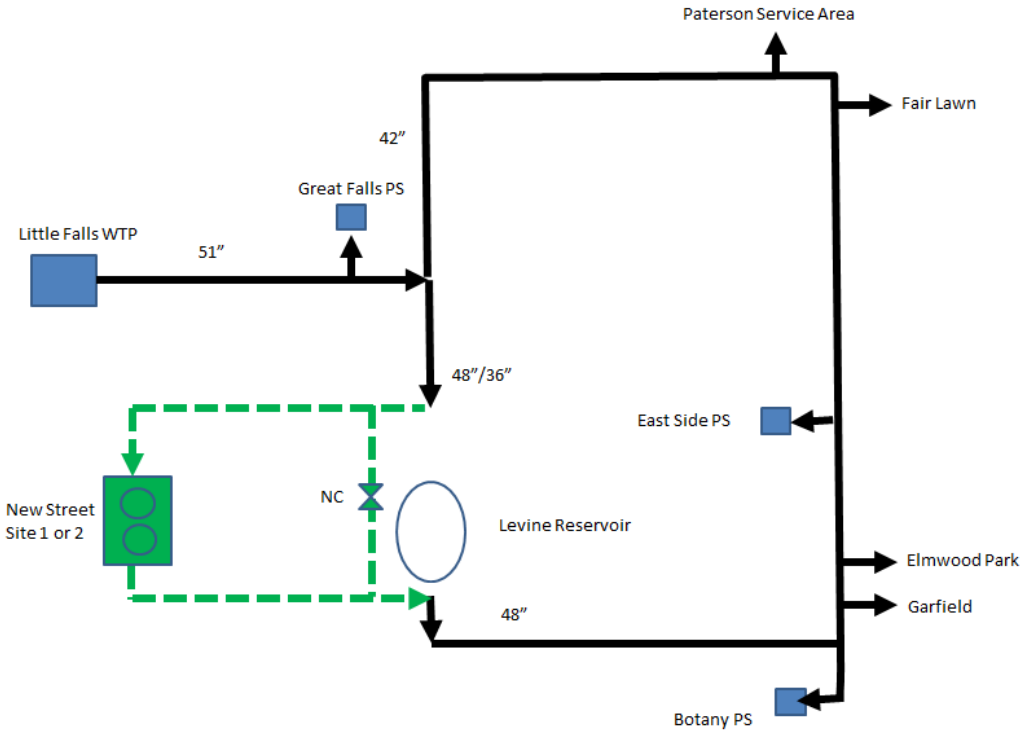


Figure 2-13 – Industrial Gradient with Tanks at Site 3

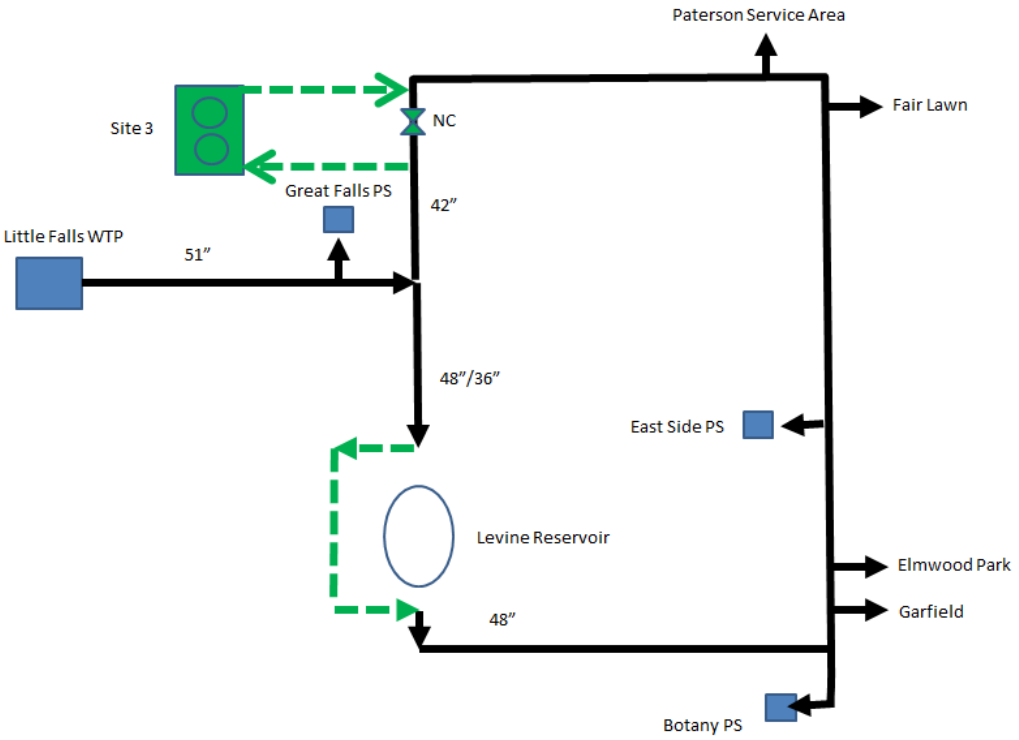
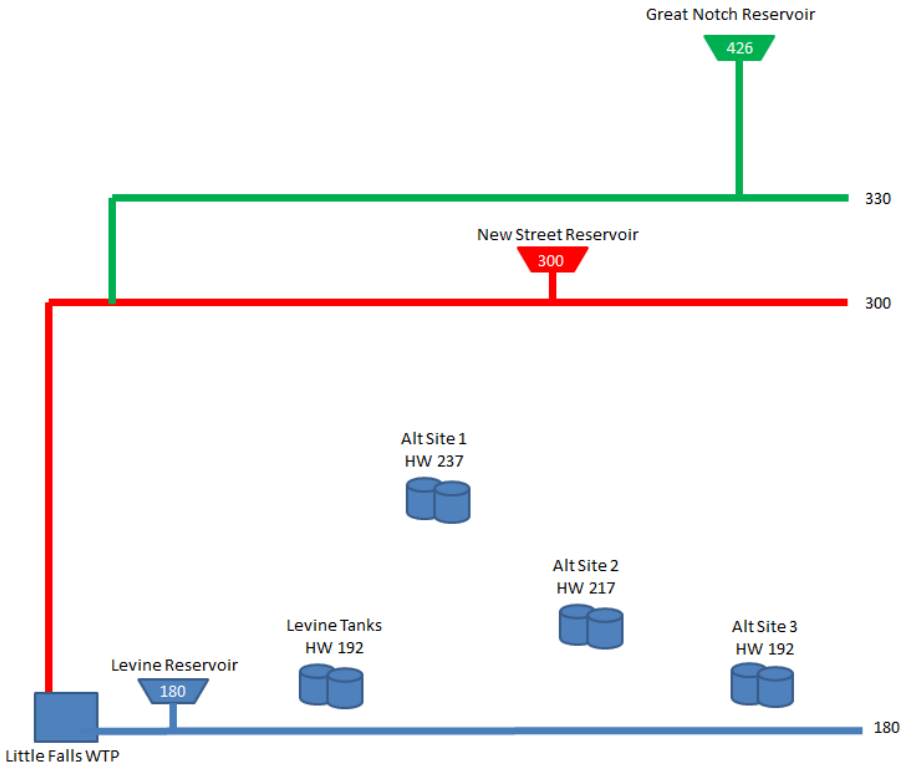


Figure 2-14 presents hydraulic elevations of the relevant portions of the PVWC water system, and the elevations of the three alternative sites considered.

Figure 2-14 – Hydraulic Elevations (in feet)



As described in Section 2.2, Sites 1 and 2 are situated at a significantly higher elevation than the existing Levine reservoir, and it would therefore not be feasible to construct the tanks at the current proposed floor elevation of 175 feet. With consideration to the fact that significant excavation and grading would still be required to construct the foundations and underdrain systems, the tank floor elevations would be 220 feet at Site 1 and 200 feet at Site 2. Both sites would have a major difference between the floor elevation and the 180 gradient. At a minimum, is anticipated that the existing pumping systems would need to be upgraded to be able to fill the tanks at these elevations. A more serious concern is the potential for severe impacts on the existing distribution system. At the high water levels of 217 to 237 feet, the resulting increase in pressure on the 180 gradient would be 16 to 25 pounds per square inch. Considering the age of the distribution system in this gradient, this increase in pressure could result in severe damage, even with the installation of pressure reducing valves.

Figures 2-15, 2-16, 2-17 and 2-18 present cross sectional views of each of the proposed sites.

2.5 Off-Site Piping

Figures 2-19, 2-20 and 2-21 present conceptual alignments of off-site piping from each site.

There are no major PVWC transmission mains located near Sites 1 and 2. For these sites, it would be necessary to construct an inlet pipe from the Levine Reservoir to the site, and an outlet pipe from the site to Grand Street. It would also be necessary to construct a pipe to carry tank overflow from the site back to the drain at Levine Reservoir. It is assumed that the inlet and outlet pipes would be 36” diameter and an overflow pipe at 30” diameter based upon flow rates established for the Levine tank design. The distance between the sites is approximately one half mile but would require crossing Interstate 80. It is assumed that micro-tunneling would be necessary to construct the crossings.

At Site 3, an existing 42” PVWC main runs along the river at the bottom of the cliff below the site. Both the inlet and outlet pipes could be tapped into the 42” main approximately one half mile away on Wayne Avenue with piping run along Jasper Street, Maple Street and possibly Walnut Street if necessary to avoid the Paterson Great Falls National Park area. Conceptual level calculations indicate that a tank overflow of short (15 minute) duration could be discharged to the stormwater detention system. It is assumed that there are existing stormwater conveyance facilities leaving the site, as the site was recently re-developed for residential use. For this site, it would be necessary to construct a pipe bypassing Levine Reservoir to bring the tank outlet flow to Grand Street.

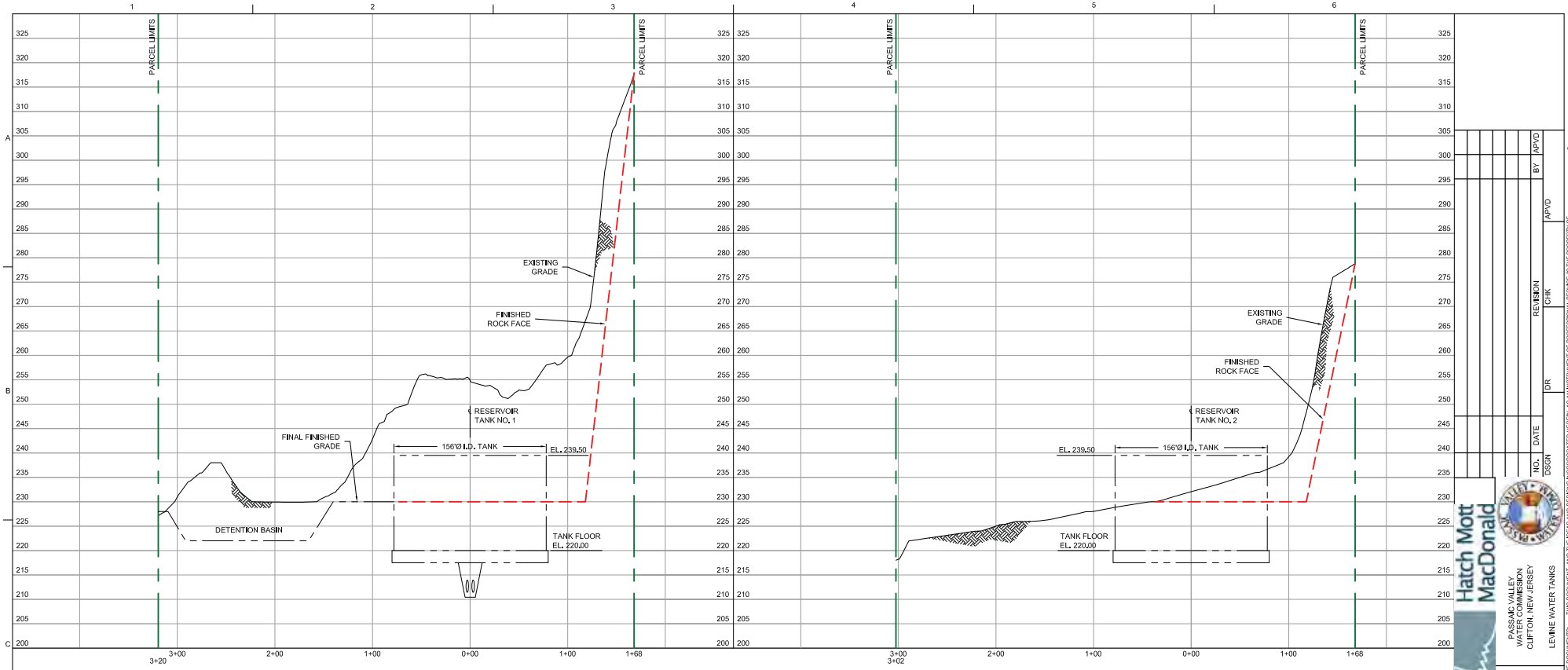
2.6 Environmental and Land Use

Spatial data available from NJDEP GIS databases were used to map environmental constraints within the project area for each site.

2.6.1 Critical Habitat and Historic Sites

Critical habitats and historic sites within the project areas are shown on Figures 2-22, 2-23, and 2-24. Spatial data from NJDEP indicates that the Passaic River meets habitat-specific requirements for the Great Blue Heron, and occurrences of the Great Blue Heron have been confirmed at the River, but no confirmed occurrences are documented within the proposed construction areas for each site and it is unlikely that the proposed project would have an impact on this species.

The Levine Reservoir and much of the surrounding project area are part of the Great Falls of Paterson/Society for Useful Manufactures (SUM) National Historic District. The Great Falls Historic District has been listed on the National Register of Historic Places since 1970 and was designated a National Historic Landmark in 1976. Unlike any other district in the City of Paterson, the Great Falls Historic District carries the extra provision of being a designated historic district, which according to the 2014 Paterson Master Plan,



CROSS SECTION - TANK 1

CROSS SECTION - TANK 2

0 50 100 150
1"=50'
HORIZONTAL

0 10 20 30
1"=10'
VERTICAL

Figure 2-15
Site 1 Cross Sections (1 of 2)

NO.	DATE	DR	CHK	APVD
DSGN	REVISION		BY	APVD

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CLIFTON, NEW JERSEY
LEVINE WATER TANKS

CH2MHILL

ALTERNATE SITE 1
(FORMER QUARRY ON NEW STREET)
CROSS SECTIONS

VERIFY SCALE
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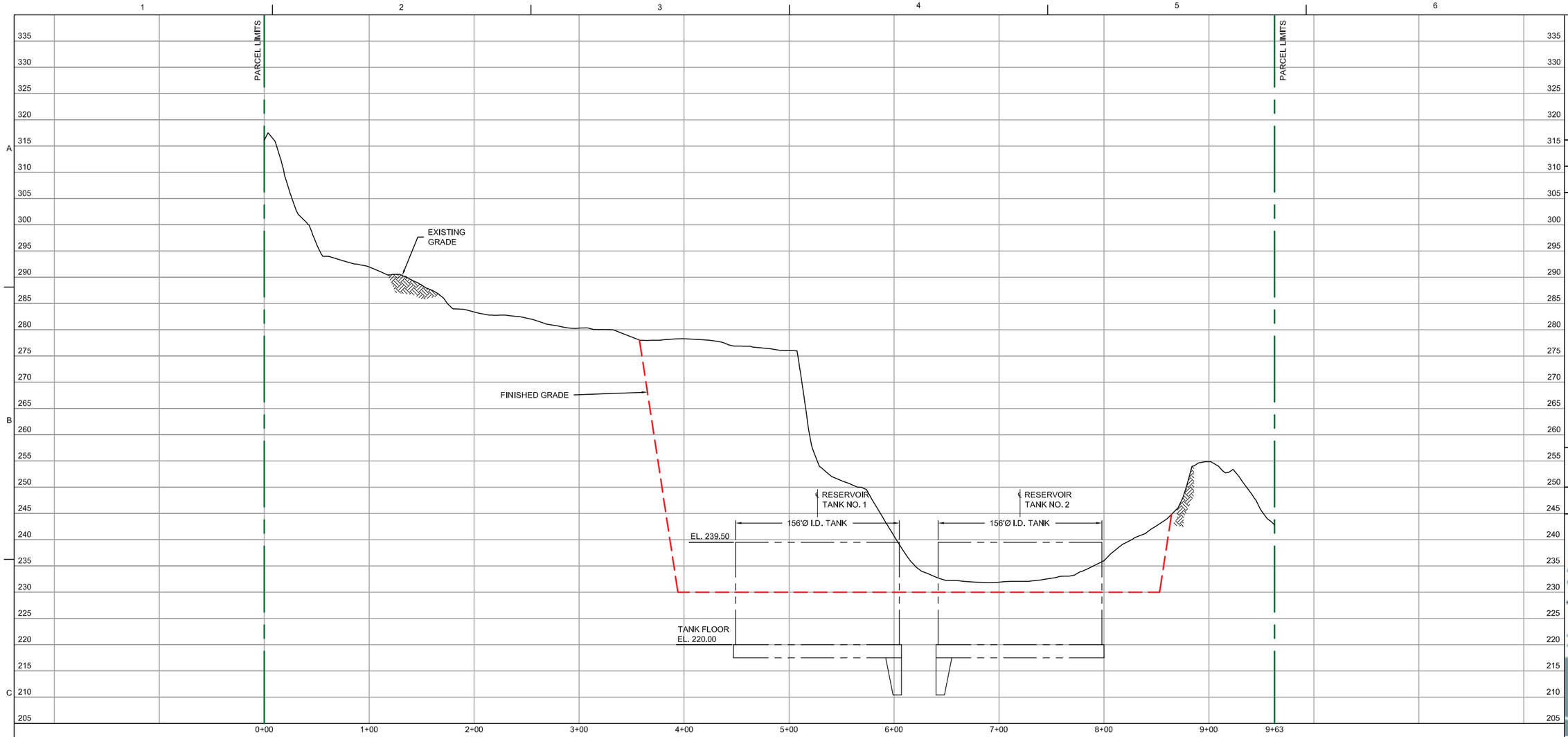

PROFILE - FORMER QUARRY ON NEW STREET

0 50 100 150
1"=50'
HORIZONTAL

0 10 20 30
1"=10'
VERTICAL

Figure 2-16: Site 1 Cross Sections (2 of 2)

NO.	DATE	REVISION	DR	CHK	BY	APVD
DSGN			APVD			

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LEVINE WATER TANKS

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ALTERNATE SITE 1
(FORMER QUARRY ON NEW STREET)
PROFILE

VERIFY SCALE
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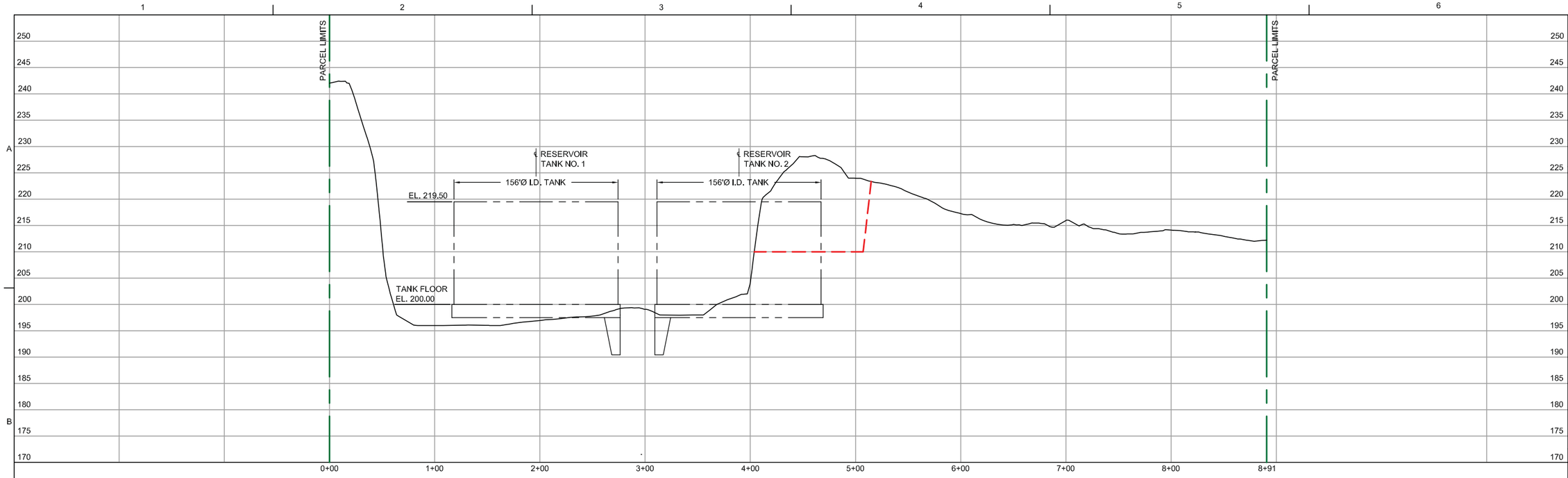
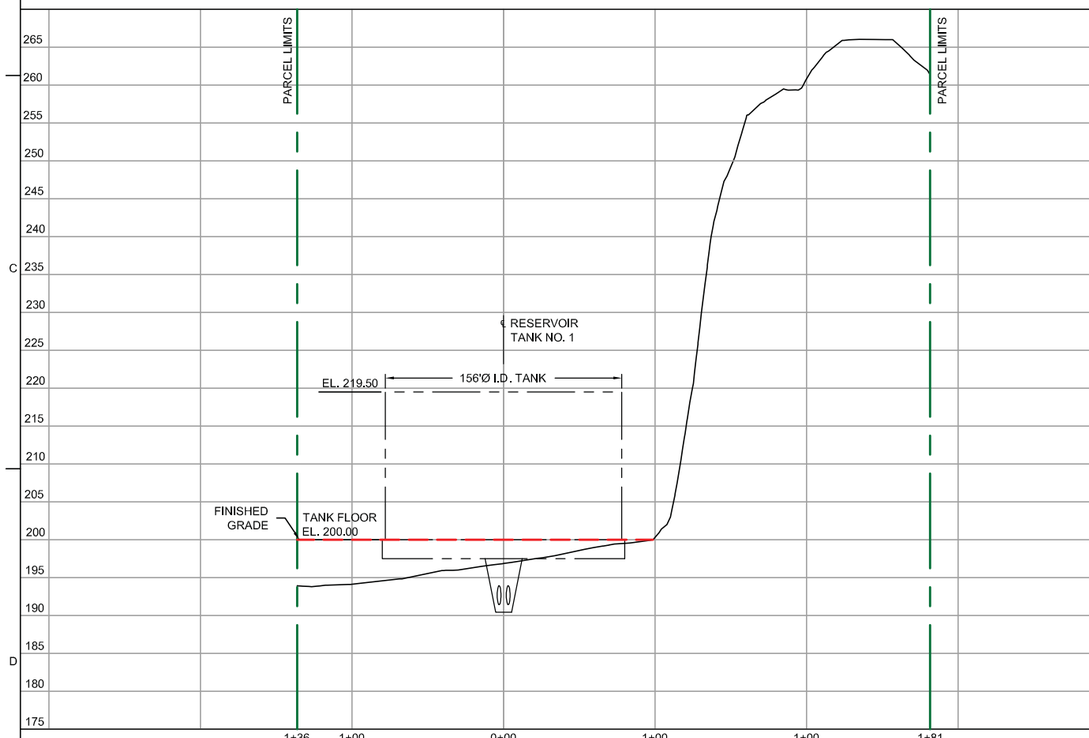
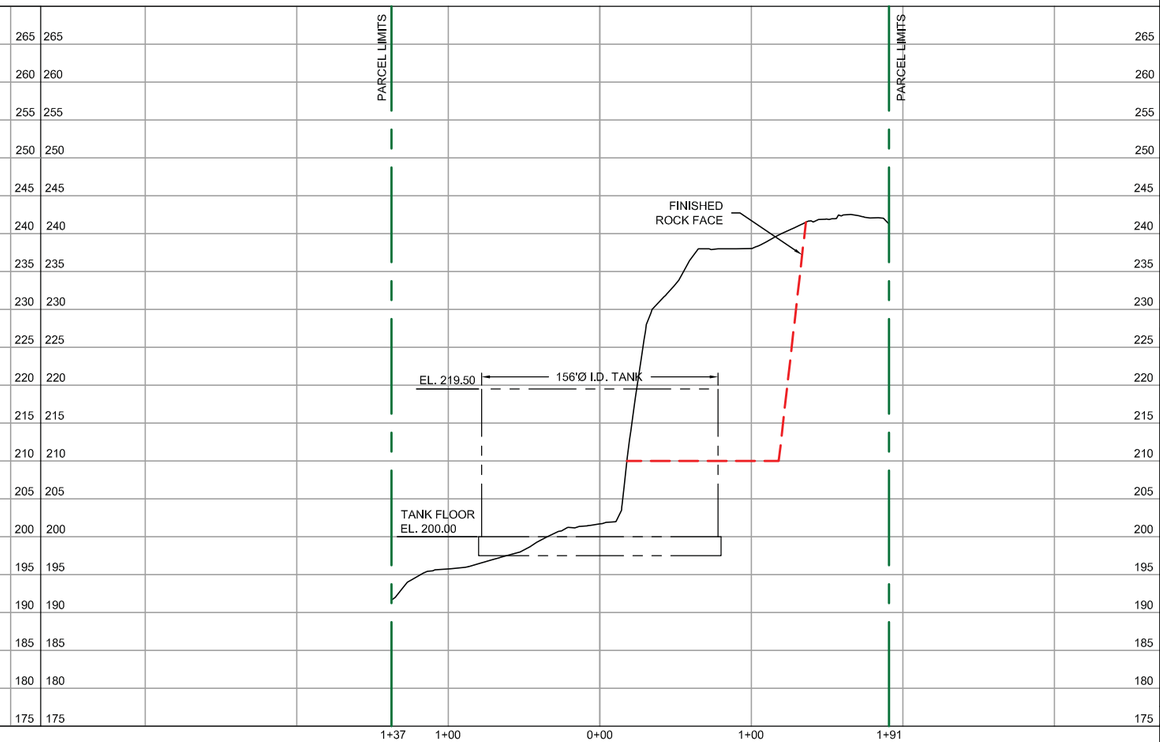


PROFILE - NEW STREET ACROSS FROM SITE 1



CROSS SECTION - TANK 1



CROSS SECTION - TANK 2

0 50 100 150
1"=50'
HORIZONTAL

0 10 20 30
1"=10'
VERTICAL

Figure 2-17: Site 2 Cross Sections

NO.	DATE	REVISION	DR	CHK	APVD	BY	APVD
DSGN							

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CLIFTON, NEW JERSEY

LEVINE WATER TANKS

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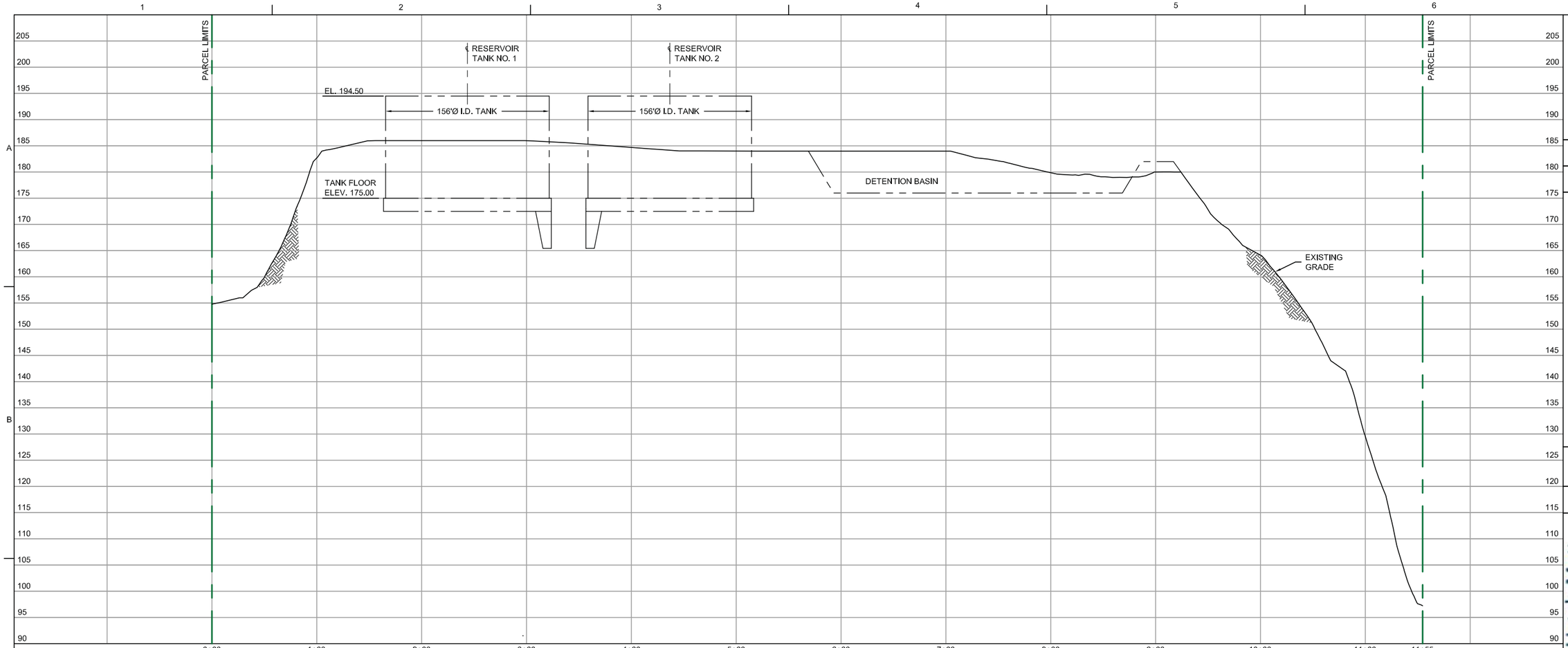
ALTERNATE SITE 2
(NEW STREETACROSS FROM SITE 1)
PROFILE AND SECTIONS

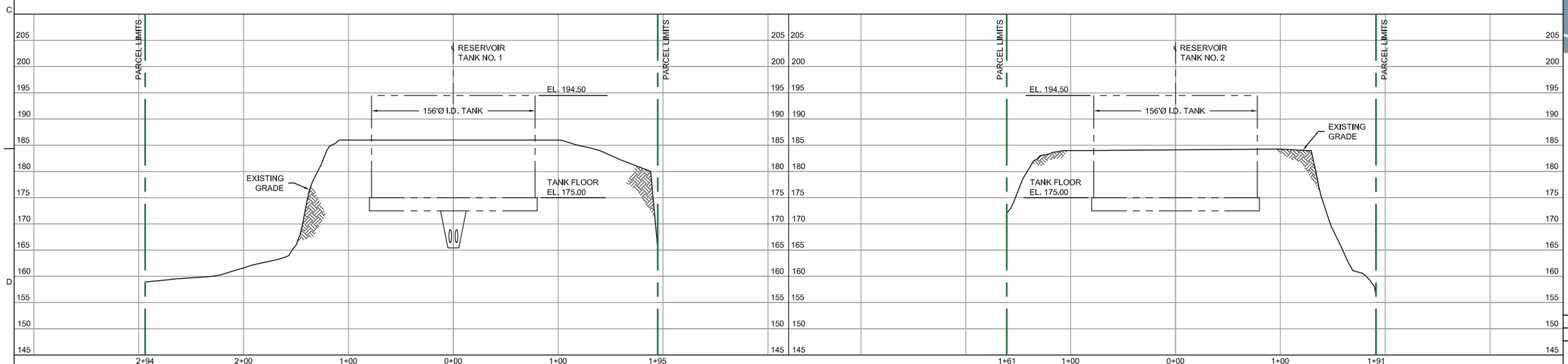
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE
PROJ
DWG
SHEET of

FILENAME: PLOT DATE: $PLOTDATE PLOT TIME: $PLOTTIME



PROFILE - THE VISTAS AT GREAT FALLS



CROSS SECTION - TANK 1

0 50 100 150
1"=50'
HORIZONTAL

0 10 20 30
1"=10'
VERTICAL

CROSS SECTION - TANK 2

Figure 2-18: Site 3 Cross Sections

NO.	DATE	REVISION	DR	CHK	APVD	BY	APVD
DSGN							

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CLIFTON, NEW JERSEY

LEVINE WATER TANKS

CH2MHILL®

ALTERNATE SITE 3
(THE VISTAS AT GREAT FALLS)
PROFILE AND SECTIONS

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE
PROJ
DWG
SHEET of

FILENAME: PLOT DATE: $PLOTDATE PLOT TIME: $PLOTTIME

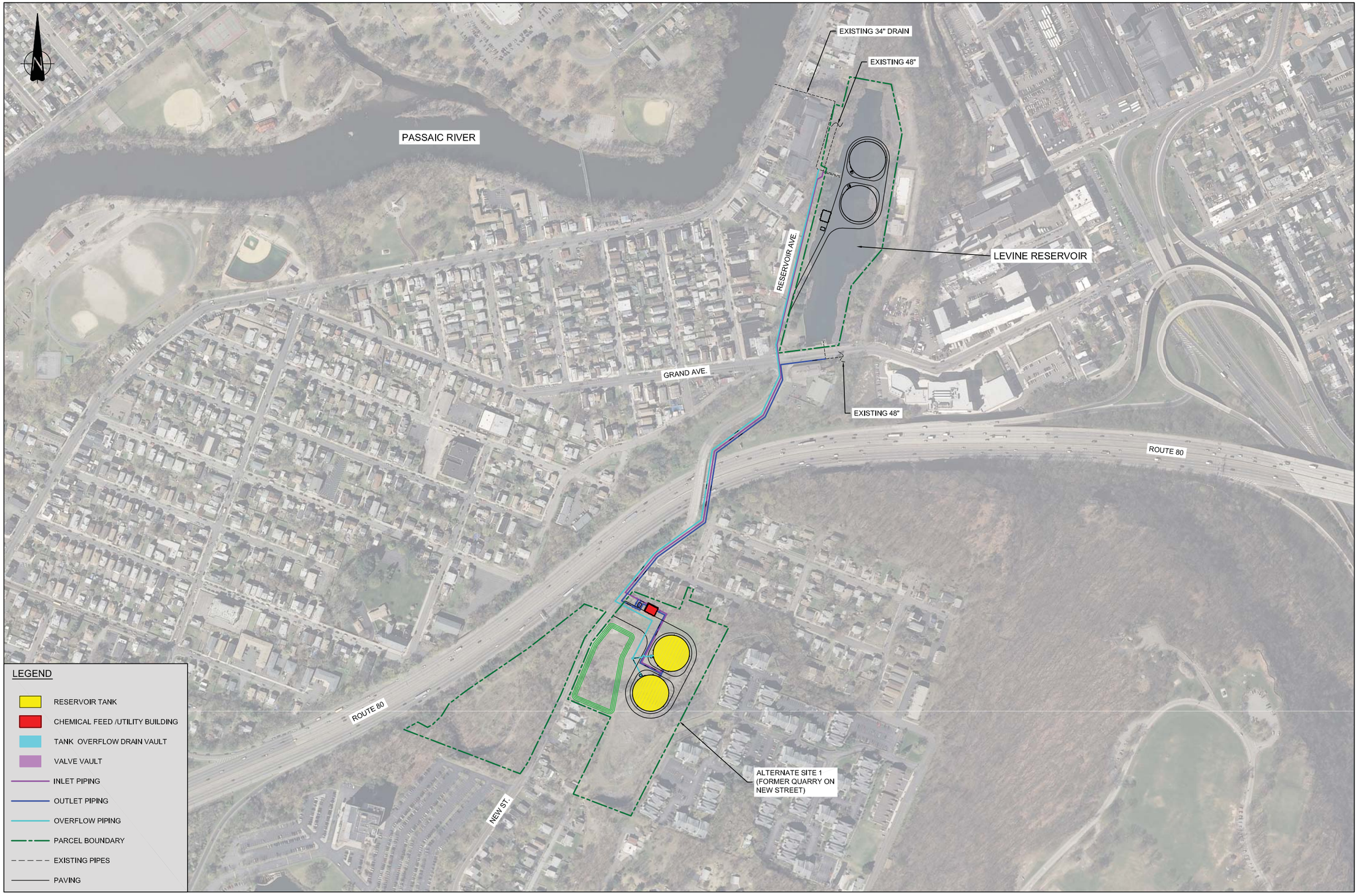

Figure 2-19: Site 1 Offsite Piping

NO.	DATE	REVISION	DR	CHK	APVD	BY	APVD
DSGN							

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CLIFTON, NEW JERSEY

LEVINE WATER TANKS

CH2MHILL®

ALTERNATE SITE 1
(FORMER QUARRY ON NEW STREET)
PLAN

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE
PROJ
DWG
SHEET of

FILENAME: PLOT DATE: $PLOTDATE PLOT TIME: $PLOTTIME

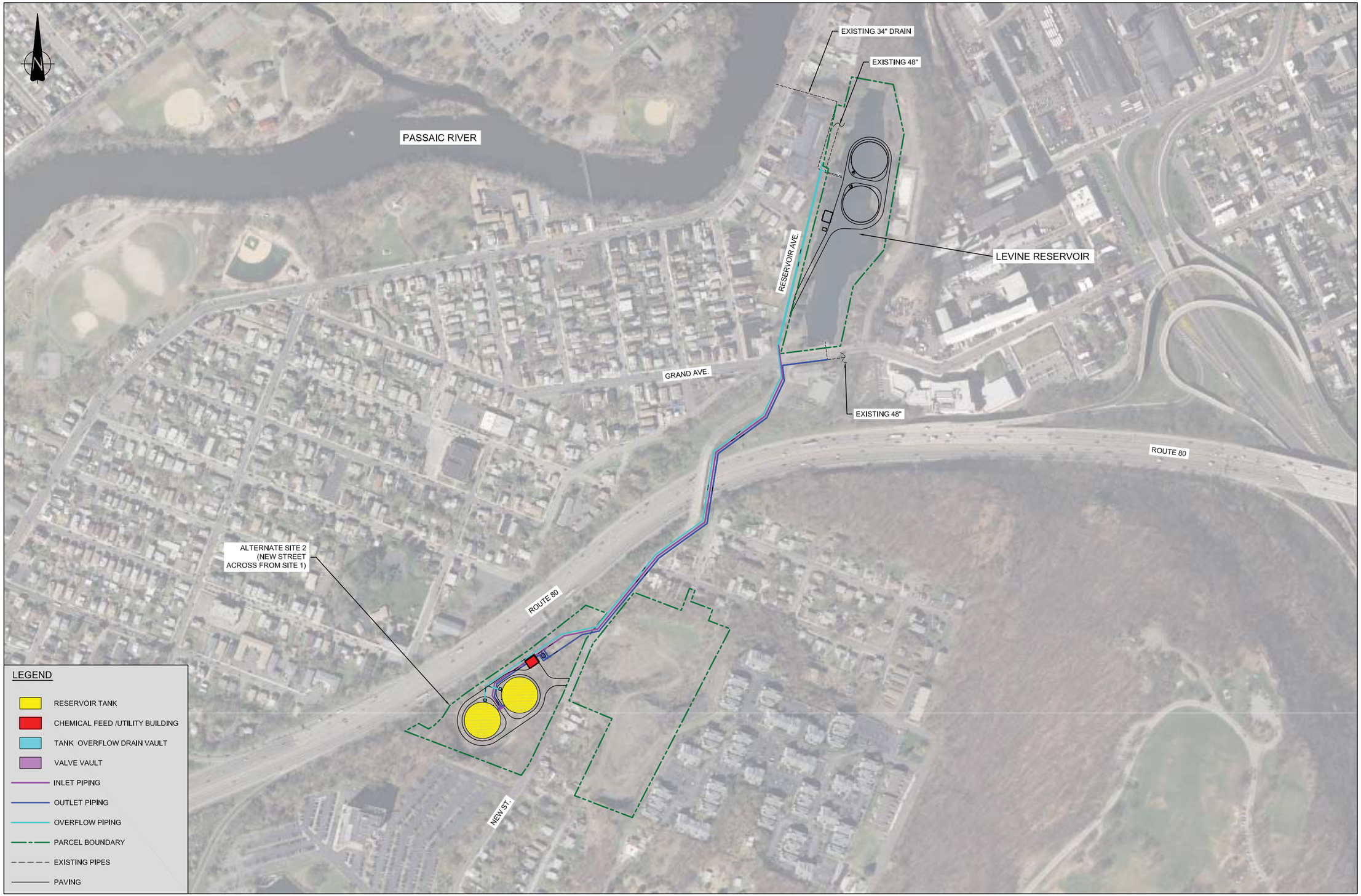

Figure 2-20: Site 2 Offsite Piping

NO.	DATE	REVISION	DR	CHK	APVD	BY	APVD
DSGN							

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CLIFTON, NEW JERSEY

LEVINE WATER TANKS

CH2MHILL®

ALTERNATE SITE 2
(NEW STREET ACROSS FROM SITE 1)
PLAN

VERIFY SCALE

BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	
PROJ	
DWG	
SHEET	of

FILENAME: PLOT DATE: $PLOTDATE PLOT TIME: $PLOTTIME

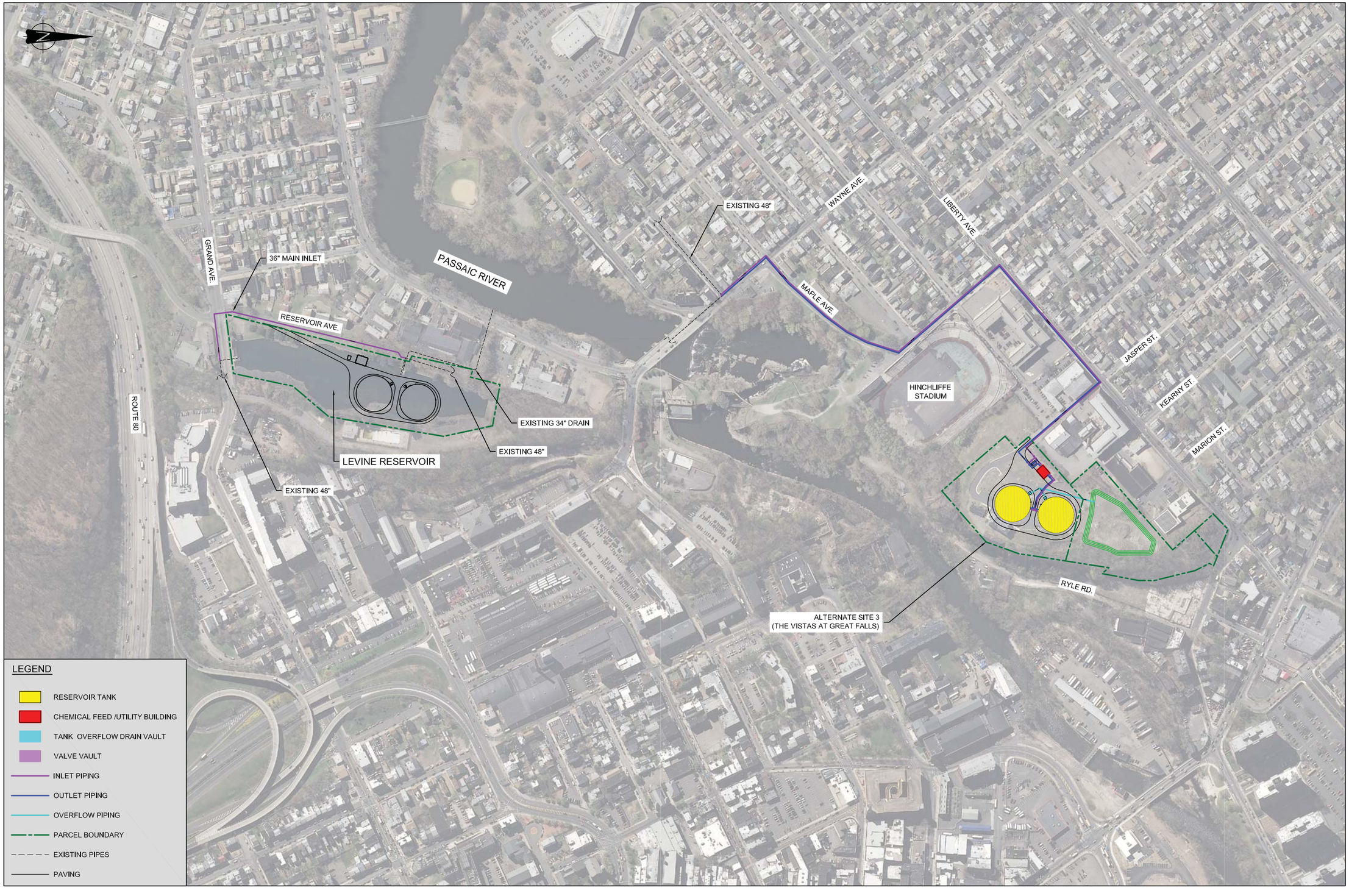

Figure 2-21: Site 3 Offsite Piping

NO.	DATE	REVISION	DR	CHK	APVD	BY	APVD
DSGN							

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CLIFTON, NEW JERSEY

LEVINE WATER TANKS

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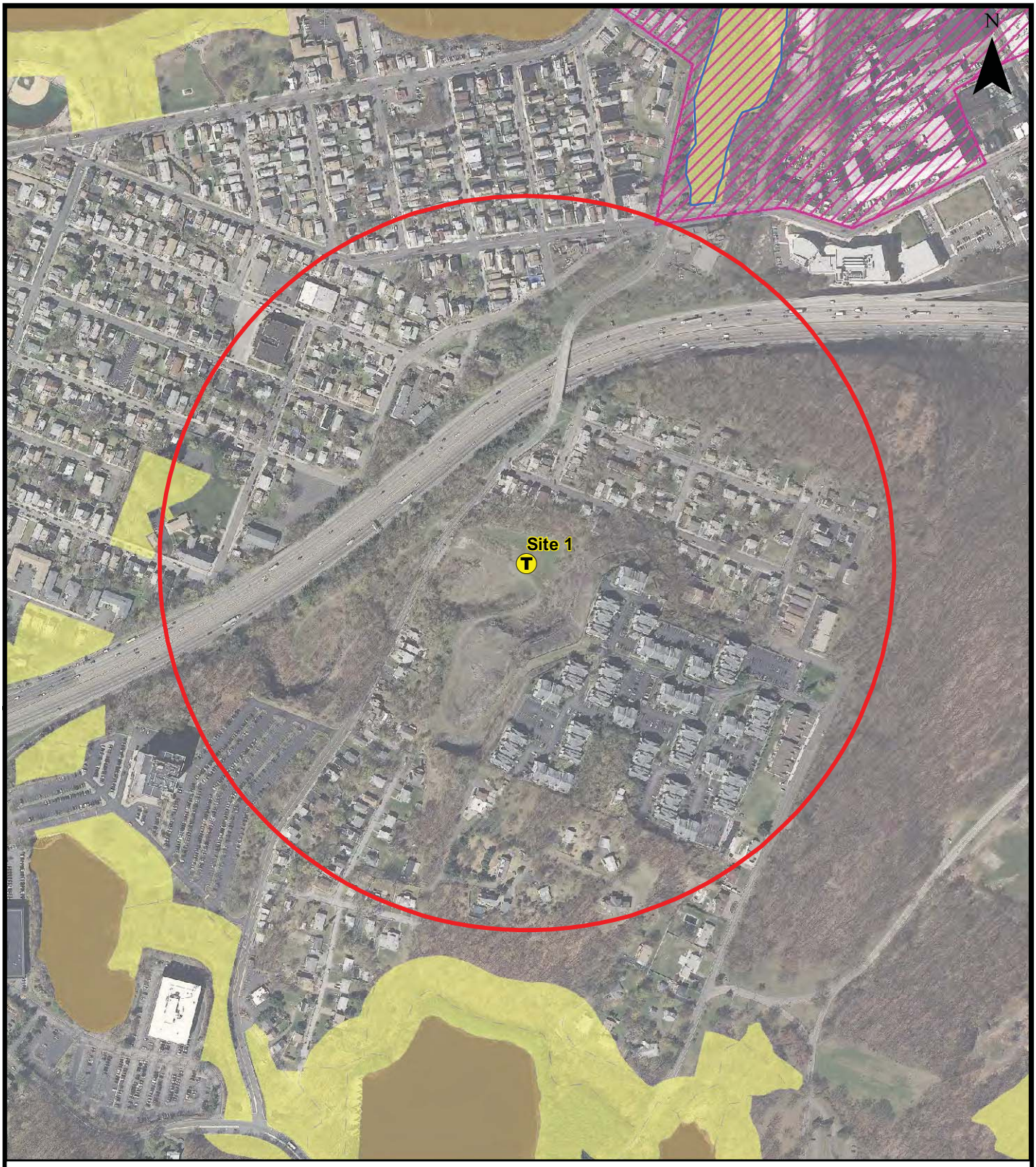
ALTERNATE SITE 3
(THE VISTAS AT GREAT FALLS)
PLAN

VERIFY SCALE

BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE
PROJ
DWG
SHEET of

FILENAME: PLOT DATE: $PLOTDATE PLOT TIME: $PLOTTIME



LEGEND

- T — Proposed Tank Site 1
- Project Area
- Great Falls / S.U.M. National Historic District

Species-Based Habitat - Piedmont Plains

- Rank 1 - Areas which meet habitat-specific requirements, but lack confirmed occurrences
- Rank 2 - Documented occurrence of species of special concern (Great Blue Heron)

Geospatial data obtained from NJDEP indicates that wetlands and vernal habitats do not occur in this area.

0 250 500 1,000 Feet

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Iselin, New Jersey

PASSAIC VALLEY WATER COMMISSION
LEVINE TANK SITE 1
PATERSON, NEW JERSEY
Figure 2-22: Site 1
Critical Habitats and Historic Sites

Designed	Drawn	Checked	Approved	Date
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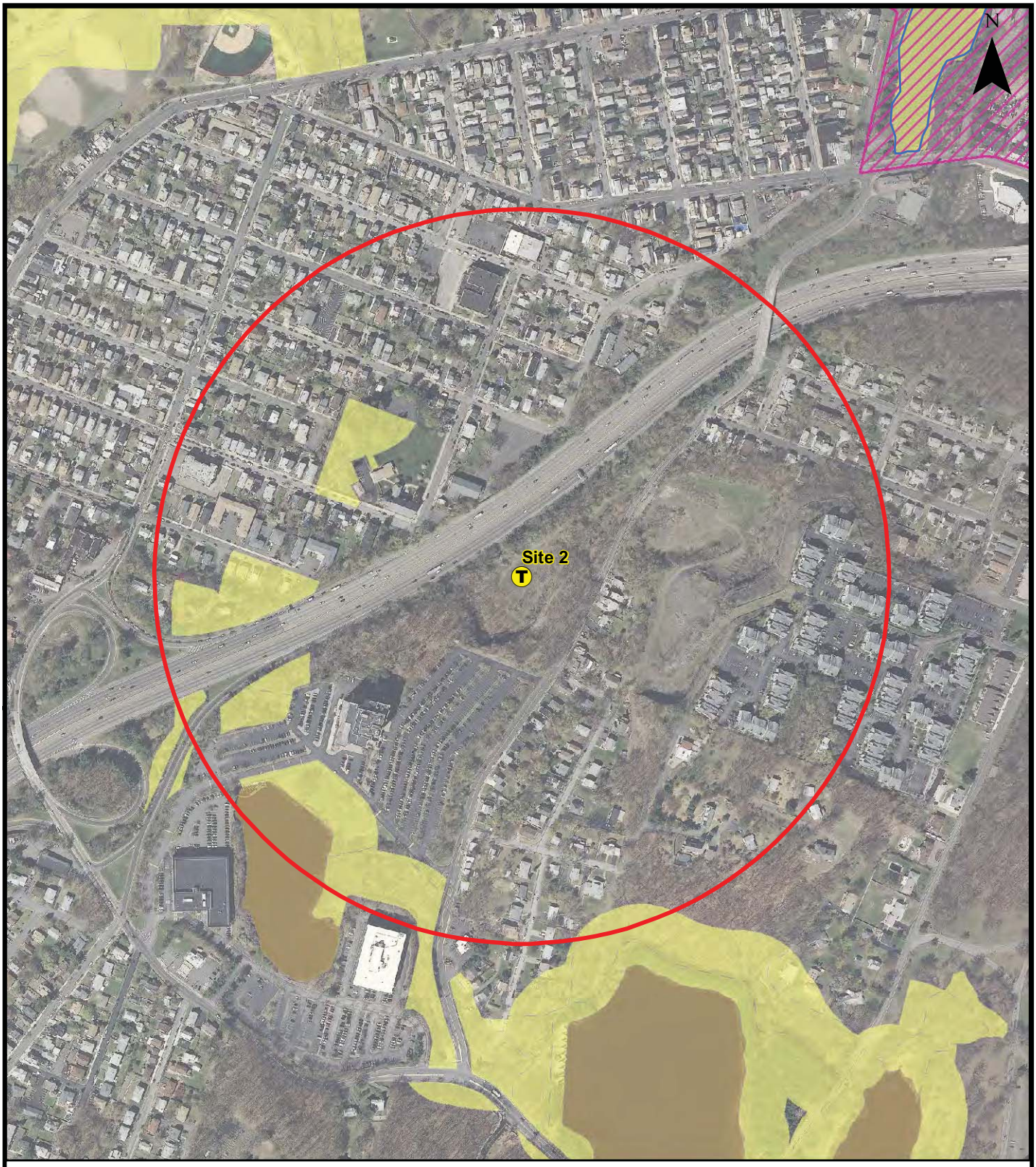

LEGEND

- T — Proposed Tank Site 2
- Project Area
- Great Falls / S.U.M. National Historic District

Species-Based Habitat - Piedmont Plains

- Rank 1 - Areas which meet habitat-specific requirements, but lack confirmed occurrences
- Rank 2 - Documented occurrence of species of special concern (Great Blue Heron)

Geospatial data obtained from NJDEP indicates that wetlands and vernal habitats do not occur in this area.

0 250 500 1,000 Feet

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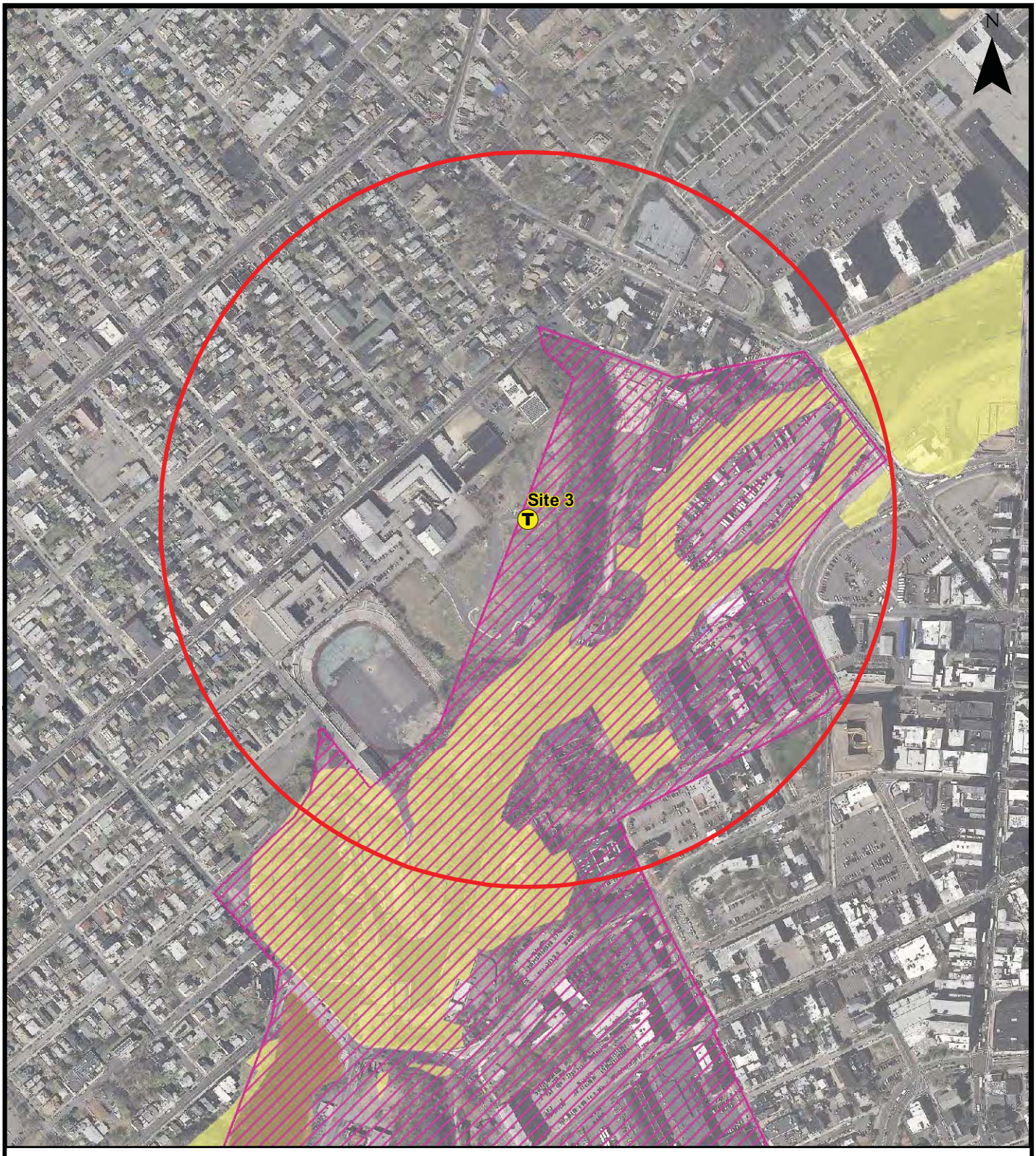
PASSAIC VALLEY WATER COMMISSION
LEVINE TANK SITE 2
PATERSON, NEW JERSEY

Figure 2-23: Site 2
Critical Habitats and Historic Sites

Designed	Drawn	Checked	Approved	Date
JMF	JMF			7/13/2014

Document Path: P:\306373\GIS\NJLevel2Review\Site 2\Figure 5 - Critical Habitat and Historic Sites.mxd



LEGEND

- T — Proposed Tank Site 3
- Project Area
- Great Falls / S.U.M. National Historic District

Species-Based Habitat - Piedmont Plains

- Rank 1 - Areas which meet habitat-specific requirements, but lack confirmed occurrences
- Rank 2 - Documented occurrence of species of special concern (Great Blue Heron)

Geospatial data obtained from NJDEP indicates that wetlands and vernal habitats do not occur in this area.

0 250 500 1,000 Feet

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PASSAIC VALLEY WATER COMMISSION
LEVINE TANK SITE 3
PATERSON, NEW JERSEY
Figure 2-24: Site 3
Critical Habitats and Historic Sites

Designed	Drawn	Checked	Approved	Date
JMF	JMF			7/13/2014

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means that any application for a building or zoning permit in this district shall be reviewed by the Paterson Historic Preservation Commission for their approval. The Reservoir site and a portion of Site 3 fall within the Great Falls Historic District. Sites 1 and 2 are not located within the Historic District.
In order to comply with 36 CFR Part 800, "Protection of Historic Properties", an undertaking that entails some type of Federal involvement (i.e. funding, permitting, action), must undergo a review under the Section 106 process which affords the appropriate parties an opportunity to participate, comment, and approve. The work at the Levine reservoir and any of the three sites is such an undertaking due to the source of the funding. The location of the proposed construction does not matter in terms of the need for the Section 106 review.

An Application for Project Authorization to the New Jersey SHPO is required when a project might "encroach upon, damage or destroy any area, site, structure or object included in the [NJ] Register of Historic Places**."** (N.J.S.A. 13:1B-15, 128 et seq). For work at Levine, the Project Authorization is required by virtue of the fact that the nearby Morris Canal is NJ Register listed and the Levine Reservoir is within the NJ Register listed Paterson Great Falls SUM Historic District. Sites 1 and 2 are each within 400 feet of the Morris Canal and would likewise need Project Authorization. Site 3 is directly adjacent to the NJ Register -listed Hinchliffe Stadium and the NJ Register-listed Paterson Great Falls SUM Historic District and therefore needs an Application.

In a previous review of the conceptual design of the proposed project at the Reservoir site, the State Historic Preservation Office (SHPO) indicated an opinion that the Levine Reservoir is a contributing element within the Historic District[1]. As described in Section 2.2, Site 3 was the former location of two of PVWC's earliest reservoirs, the Upper (Totowa) and Middle reservoirs. According to documentation from Maser Consulting, portions of the Middle and Totowa reservoir structures were found, documented and demolished during construction of the Vistas condominium complex.

2.6.2 Floodplains

As shown on Figures 2-25, 2-26 and 2-27, the proposed sites are well outside of the flood plain, as is the Levine site.

2.6.3 Land Use and Wetlands

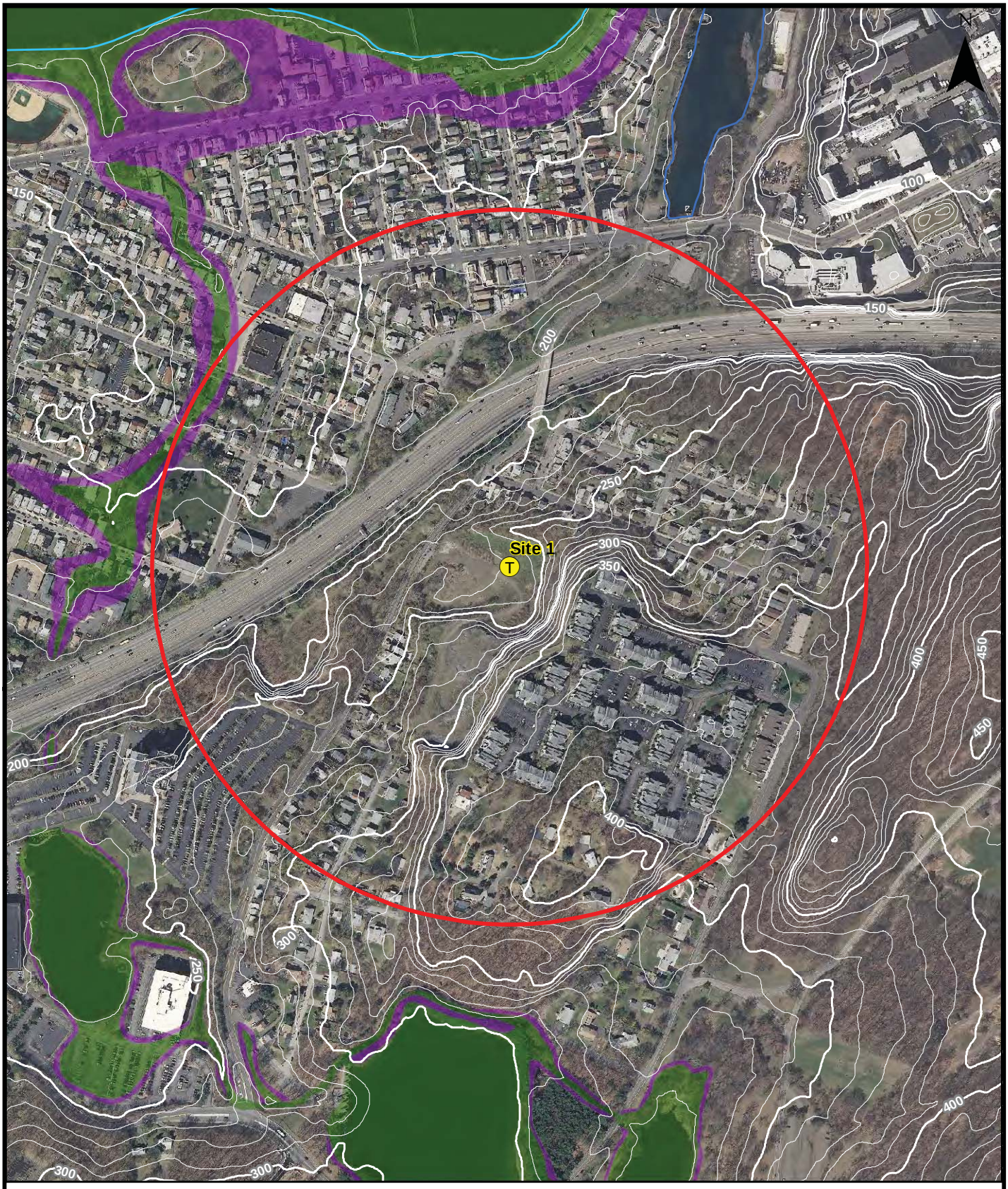
Figures 2-28, 2-29 and 2-30 show land use/land cover data as of 2007. The proposed sites are primarily urban and forested. Although no wetlands are shown to be present in State mapping, additional site investigations would be required, as all three sites were observed to have areas of standing water and possible wetlands vegetation when inspected. At Sites 1 and 2, these areas were observed within the proposed construction area. At Site 3, the wet areas were at the far north end of the site and none were observed within the proposed construction area. A site investigation was conducted at the Levine site and no wetlands were found. This finding was confirmed in a Letter of Interpretation from NJDEP dated 6/2/14.

2.6.4 Zoning

Zoning of the three alternate sites is shown on Figures 2-31, 2-32 and 2-33, based upon information available in land use/land cover data from NJDEP, 2012 aerial photography, the March 2012 Paterson Zoning Map, and Planned Land Use information included in the January 2012 Woodland Park Master Plan.

The ¼ mile radius project area of Site 1 includes residential areas, a light industrial district, and a planned unit development district consisting of both residential and commercial development. The light industrial district is parallel to the I-80 corridor, which traverses the project area approximately 500 feet

[1] Letter from Daniel D. Saunders, SHPO, to Alphonse Sessa, TY-Lin International/Medina, November 24, 2010



LEGEND

- T — Proposed Tank Site 1
- Project Area
- Passaic River

National Flood Hazard

- 0.2% Annual Flood Hazard
- AE 1% Annual Flood Hazard
- AO 1% Annual Flood Hazard (Shallow)

10-foot contours generated
from National Elevation Dataset
2012 Orthophotography NJ MrSID Tiles

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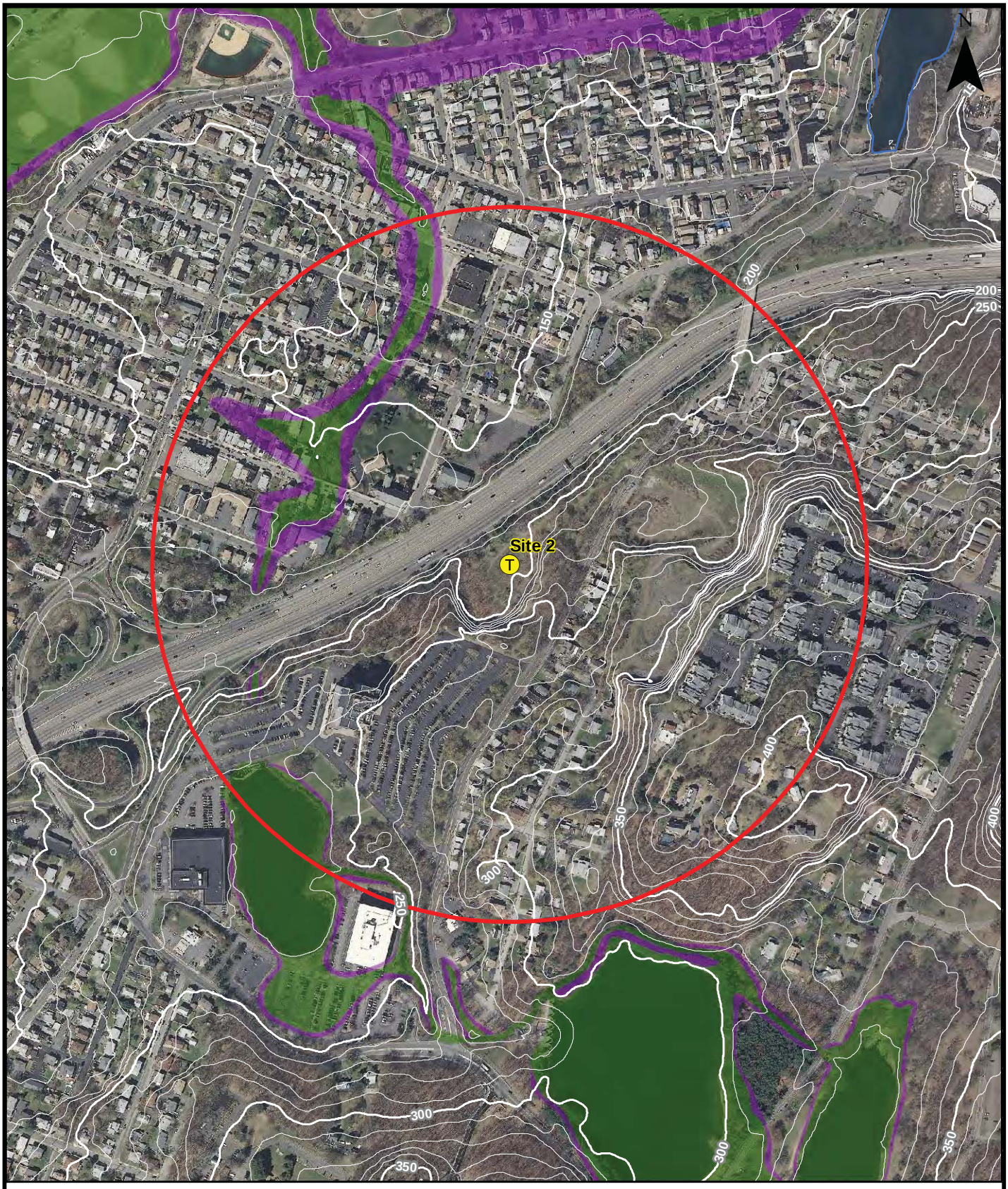
PASSAIC VALLEY WATER COMMISSION
LEVINE TANK SITE 1
PATERSON, NEW JERSEY
Figure 2-25: Site 1
Floodplains & Elevation

Designed	Drawn	Checked	Approved	Date
JMF	JMF	SRR		7/13/2014

Document Path: P:\306373\GIS\NJLevel2Review\Site 1\Figure 6 - Floodplains and Elevation.mxd



LEGEND

- T — Proposed Tank Site 2
- Project Area
- Passaic River

National Flood Hazard

- 0.2% Annual Flood Hazard
- AE 1% Annual Flood Hazard
- AO 1% Annual Flood Hazard (Shallow)

10-foot contours generated
from National Elevation Dataset
2012 Orthophotography NJ MrSID Tiles

0 250 500 1,000 Feet

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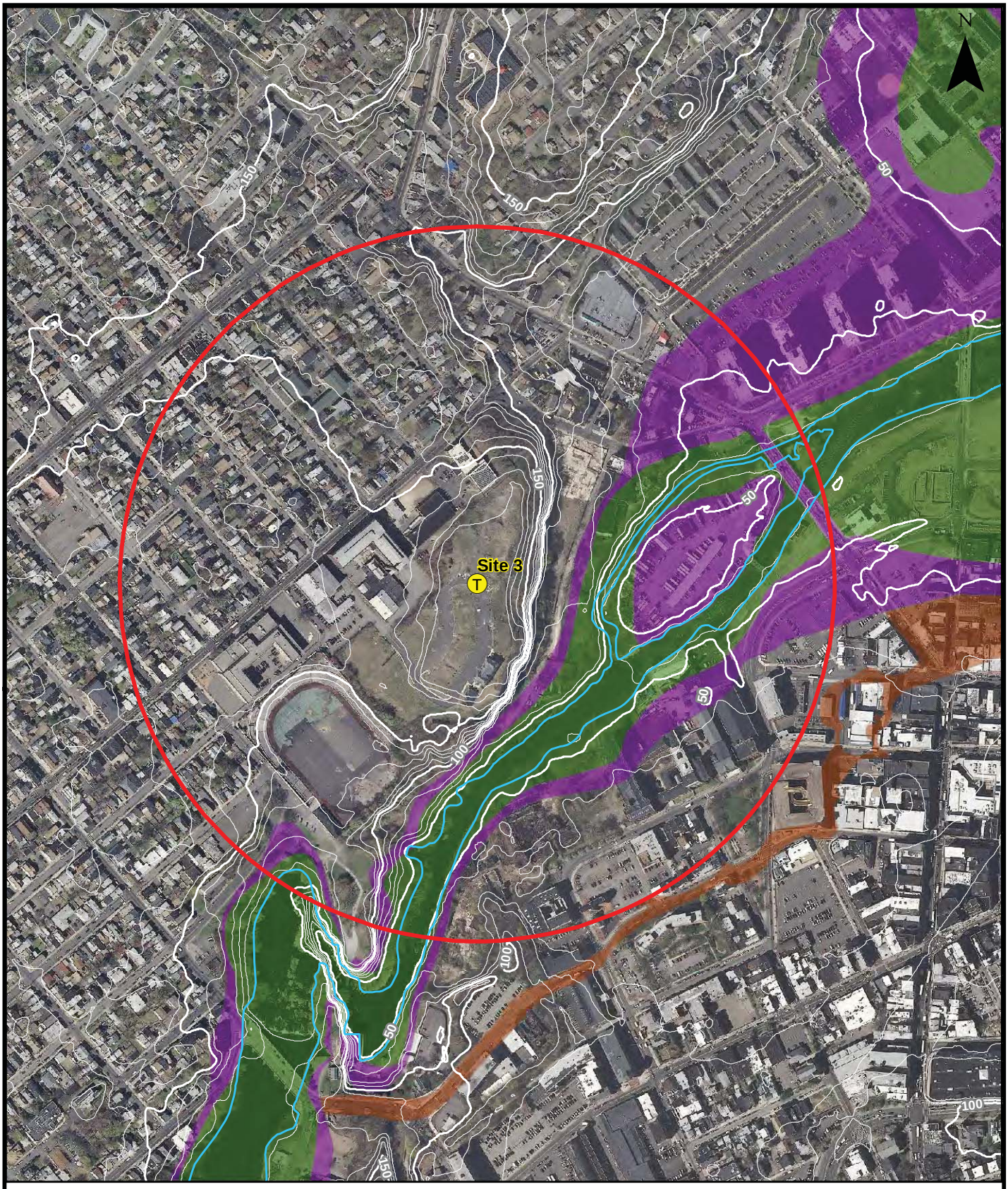
PASSAIC VALLEY WATER COMMISSION
LEVINE TANK SITE 2
PATERSON, NEW JERSEY
Figure 2-26: Site 2
Floodplains & Elevation

Designed	Drawn	Checked	Approved	Date
JMF	JMF			7/13/2014

Document Path: P:\306373\GIS\NJLevel2Review\Site 3\Figure 6 - Floodplains and Elevation.mxd



LEGEND

- T — Proposed Tank Site 3
- Project Area
- Passaic River

National Flood Hazard

- 0.2% Annual Flood Hazard
- AE 1% Annual Flood Hazard
- AO 1% Annual Flood Hazard (Shallow)

10-foot contours generated
from National Elevation Dataset
2012 Orthophotography NJ MrSID Tiles

0 250 500 1,000 Feet

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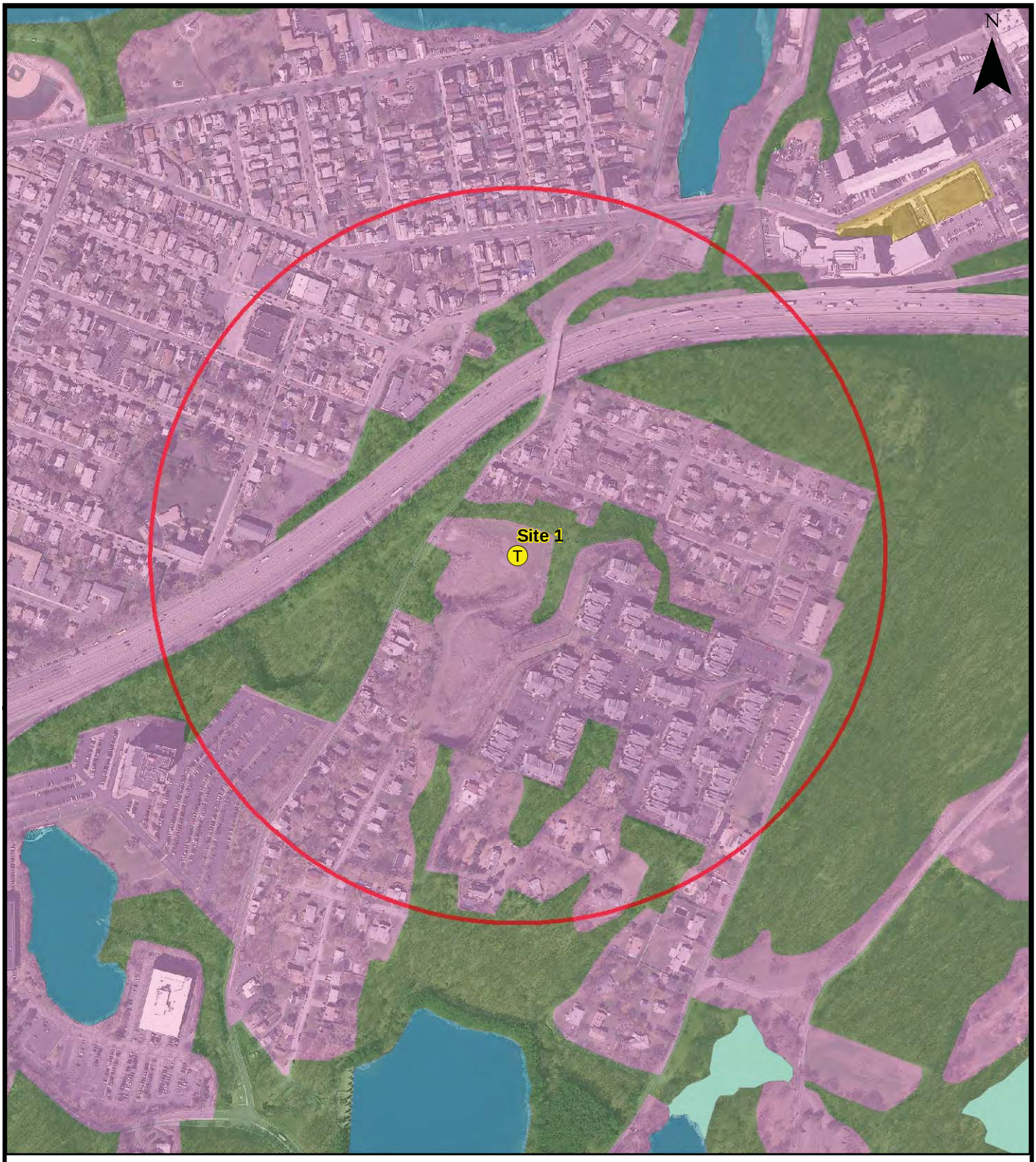
LEVINE TANK SITE 3
PATERSON, NEW JERSEY
Figure 2-27: Site 3
Floodplains and Elevation

Designed	Drawn	Checked	Approved	Date
JMF	JMF			7/13/2014

Document Path: P:\306373\GIS\NJLevel2Review\Site 2\Figure 6 - Floodplains and Elevation.mxd



LEGEND

- T — Proposed Tank Site 1
- Project Area
- Wetlands

Lower Passaic and Saddle River Watershed Management Area
Land Use / Land Cover (2007)

- BARREN LAND
- FOREST
- URBAN
- WATER

0 250 500 1,000 Feet

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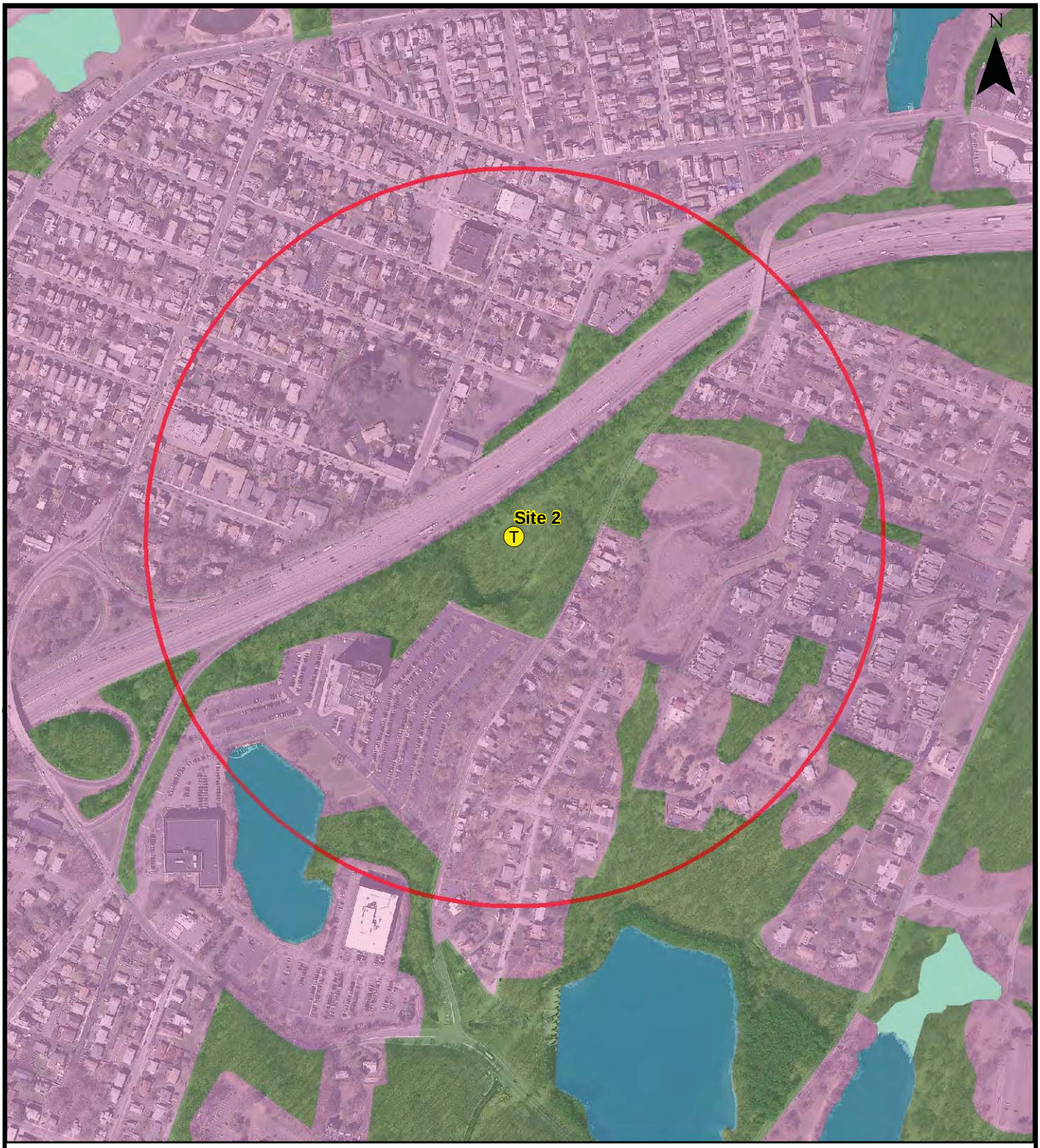
PASSAIC VALLEY WATER COMMISSION
LEVINE TANK SITE 1
PATERSON, NEW JERSEY

Figure 2-28: Site 1 Land Use

Designed	Drawn	Checked	Approved	Date
JMF	JMF			7/11/2014

Document Path: P:\306373\GIS\NJLevel2Review\Site 1\Figure 7 - Land Use.mxd



LEGEND

- T — Proposed Tank Site 2
- Project Area
- Wetlands

Lower Passaic and Saddle River Watershed Management Area
Land Use / Land Cover (2007)

- BARREN LAND
- FOREST
- URBAN
- WATER

0 250 500 1,000 Feet

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PASSAIC VALLEY WATER COMMISSION
LEVINE TANK SITE 2
PATERSON, NEW JERSEY
Figure 2-29: Site 2 Land Use

Designed	Drawn	Checked	Approved	Date
JMF	JMF	SRR		7/10/2014

Document Path: P:\306373\GIS\NJLevel2Review\Site 2\Figure 7 - Land Use.mxd

LEGEND

Lower Passaic and Saddle River Watershed Management Area
Land Use / Land Cover (2007)

- BARREN LAND
- FOREST
- URBAN
- WATER
- T Proposed Tank Site 3
- Project Area

0 250 500 1,000 Feet

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PASSAIC VALLEY WATER COMMISSION
LEVINE TANK SITE 3
PATERSON, NEW JERSEY

Figure 2-30: Site 3 Land Use

Designed	Drawn	Checked	Approved	Date
JMF	JMF			7/21/2014

Document Path: P:\306373\GIS\NJLevel2Review\Site 3\Figure 7 - Land Use.mxd

north/northwest of the proposed tank location. The proposed tank location lies within the western half of the planned unit development district (PUD-ROC, also known as the Garrett Heights Redevelopment Area), which includes the former New Street quarry. The eastern portion of the PUD-ROC zone is developed with clustered townhouses, while the western portion has not yet been developed. Within the project area, portions of Garrett Mountain Park are zoned by Paterson as residential, but nor residents are visible in this area of the park on aerial photographs. The southern portion of the project area intersects Woodland Park, including areas planned for residential and high-rise office land use.

The ¼ mile radius project area of Site 2 has very similar land use and zoning characteristics to Site 1. Since the project area extends further south, it includes less of the light industrial and PUD-ROC districts in Paterson, and more of the residential, high-rise office and recreation and open space planned land use areas in Woodland Park than Site 1.

The ¼ mile radius project area of Site 3 has a predominantly urban land use, with strips of forested land bordering the Passaic River, which crosses through the project area. These forested areas are part of the Valley of the Rocks Park and portions of the Great Falls National Historical Park. The proposed tank location is within the Great Falls Historic District, near the boundary with the Paterson First Ward Redevelopment Area (RP-1W). The RP-1W area is intended to revitalize the portions of the First Ward located on the north side of the Passaic River, through the acquisition and assembly of large parcels for larger scale redevelopment projects, including housing and public uses. The RP-1H area is presently developed with small scale residential and retail uses.

2.6.5 Permits and Approvals

A review of the permit requirements for construction of the tanks at an alternate site was conducted for comparison to the permit requirements at the Levine site, as summarized in the following table.

Permit/Approval	Levine	Site 1	Site 2	Site 3
NJDEP Safe Drinking Water Construction	Yes	Yes	Yes	Yes
HEPCD Soil Erosion and Sedimentation Control Plan Certification	Yes	Yes; will be more extensive and a higher review fee due to off-site piping	Yes; will be more extensive and a higher review fee due to off-site piping	Yes; will be more extensive and a higher review fee due to off-site piping
NJDEP Dam Safety Approval	Yes	Yes (for decommissioning Levine)	Yes (for decommissioning Levine)	Yes (for decommissioning Levine)
NJDEP Stormwater Management Review	Yes	Yes	Yes	Yes
Paterson Planning/Zoning Board Review	Yes, with Paterson Historic Preservation Commission approval	Yes	Yes	Yes, with Paterson Historic Preservation Commission approval
NJDEP Freshwater Wetlands Letter of Interpretation	Yes	Yes	Yes	Yes
NJDEP Freshwater Wetlands Individual Permit	No	Possible	Possible	Not expected
NJDEP Flood Hazard Area Permit	No	Not expected	Not expected	Not expected
NJDEP WQMP Consistency Determination	Yes	Yes	Yes	Yes
NJ Historic Preservation Authorization	Yes	Yes, but likely not an encroachment	Yes, but likely not an encroachment	Yes
Federal Section 106 Authorization	Yes	Yes	Yes	Yes
NJPDES Permit for Reservoir Overflow	No	Yes	Yes	Yes
NJDOT Approval (I-80 crossing)	No	Yes	Yes	No

2.7 Geotechnical Evaluation

Based on a geotechnical and geologic review of each of the proposed alternative sites and off-site piping alignments, the following constraints are identified for each of the 3 sites of the alternative analysis:

As indicated earlier, Site 1 was a former quarry, which presents numerous constraints to the construction of the tanks. The depth to bedrock ranges from grade to 3.5 feet below ground surface due to existing filling, thereby requiring substantial rock excavation to allow construction of the tank foundations. Located in the region prevalent to Orange Mountain Basalt geologic formations, rock is expected to be of igneous basalt which cannot be excavated using standard construction machinery and will require controlled blasting for removal. It is anticipated that the tank floor would be set below grade, therefore substantial rock blasting and control would be required. As the surrounding land use is residential in nature and basalt-type formations have a high shear wave velocity (5000-6000 m/s) in comparison to soil (400-700 m/s) to transmit vibrations and blast energy caused by construction, this may potentially impact residences located upslope of the proposed project site. Pre-blast surveys and monitoring during blasting would be required.

The floor grade of Site 1 is currently flat to slightly sloping; however, it sits in a depression surrounded by steep slopes of exposed bedrock. As a result, the site will collect runoff as well as stormwater, increasing the quantity of water needed to be retained at the site. Due to high bedrock surface and little soil present at the site, as well as tightness of the rock formation, there is low hydraulic conductivity of the rock formation (less than 1 inch per hour) which may restrict the infiltration of stormwater at the project site and require basins larger than the available project space to store stormwater created by new impervious surfaces. Similarly, as the proposed Site is located within an area depressed from surrounding areas, access roads and slopes for access roads may be prohibitively steep to support construction within the site constraints.

For off-site tank inlet and outlets, such as pumping from the existing reservoir to Site 1, the water will have to be pumped over half a mile and to a 50 foot increase in elevation. Due to minimal depth to bedrock and hardness of the bedrock in the area, construction of this piping system will require blasting along most of the length for alignments located within a two-mile radius of the area.

Figures 2-34 and 2-35 present bedrock and surficial geology, and soils and historic fill, for Site 1.

Site 2 is located across the street in a currently vegetated area adjacent to Site 1. Part of the site is flat with an elevation increase of 40 feet to the east. The maximum depth to bedrock at Site 2 is 4 feet below ground surface; however, the bedrock is underlying approximately 4 feet of material classified as silt loam with boulders. Similar to Site 1, following the stripping of a thin layer of overburden, the shallow depth to bedrock would also require blasting in order to excavate for the tanks and provide level finished grade to support construction of the tank floor slab. Blasted and excavated rock material may be sufficient for use as select site backfill; however the rock material will likely require crushing and processing prior to use. Tank foundations may be placed on bedrock as the formation has unconfined compressive strengths exceeding 20,000 pounds per square foot.

Based on review of available geologic and soil survey data, the hydraulic conductivity of the rock formation at Site 2 is similarly low to Site 1 (approximately 0.75 inches/hour). As a result, the site will collect runoff as well as stormwater, increasing the quantity of water needed to be retained at the site.

For off-site tank inlet and outlets, such as pumping over one-half mile from the existing reservoir to Site 2, any piping system alignment would have to be installed through bedrock. The installation of below-grade piping would likely require blasting of the basalt rock which is shallow within an approximate one-mile radius of the proposed site.

Figures 2-36 and 2-37 present bedrock and surficial geology, and soils and historic fill, for Site 2.

Site 3 is located across the river from the Levine Reservoir and located off Jasper Street. The surficial geology is similar to Site 2, with a maximum depth to bedrock is 4 feet below ground surface and is overlain by loam/topsoil material with boulders. Similar to Site 2, following the stripping of a thin layer of overburden, the shallow depth to bedrock would also require blasting in order to excavate for the tanks and provide level finished grade to support construction of the tank floor slab. Located on top of a slope, and with high shear wave velocity of the basalt rock, blasting may dislodge rock at the base of the slope or cause slope instabilities which may affect properties at the foot of the slope as well as the project site.

Blasted and excavated rock material may be sufficient for use as select site backfill; however the rock material will likely require crushing and processing prior to use. Tank foundations may be placed on bedrock as the formation has unconfined compressive strengths exceeding 20,000 pounds per square foot.

Legend

T Proposed Tank Site 1

Project Area

Stanley Levine Reservoir

Bedrock Geology

Orange Mountain Basalt
(Basalt Aquifer)

Passaic Formation
Conglomerate and Sandstone facies
(Brunswick Aquifer)

Bedrock Fault
U, upthrown; D, downthrown.
Ball shows direction of dip.

Surficial Geology

Alluvium

Glacial Lake Passaic,
Great Notch stage, delta deposits

Rahway till

Rahway till, discontinuous

Rahway till, yellow phase, discontinuous

0 250 500 1,000 Feet

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PASSAIC VALLEY WATER COMMISSION
LEVINE TANK SITE 1
PATERSON, NEW JERSEY
Figure 2-34: Site 1
Bedrock and Surficial Geology

Designed	Drawn	Checked	Approved	Date
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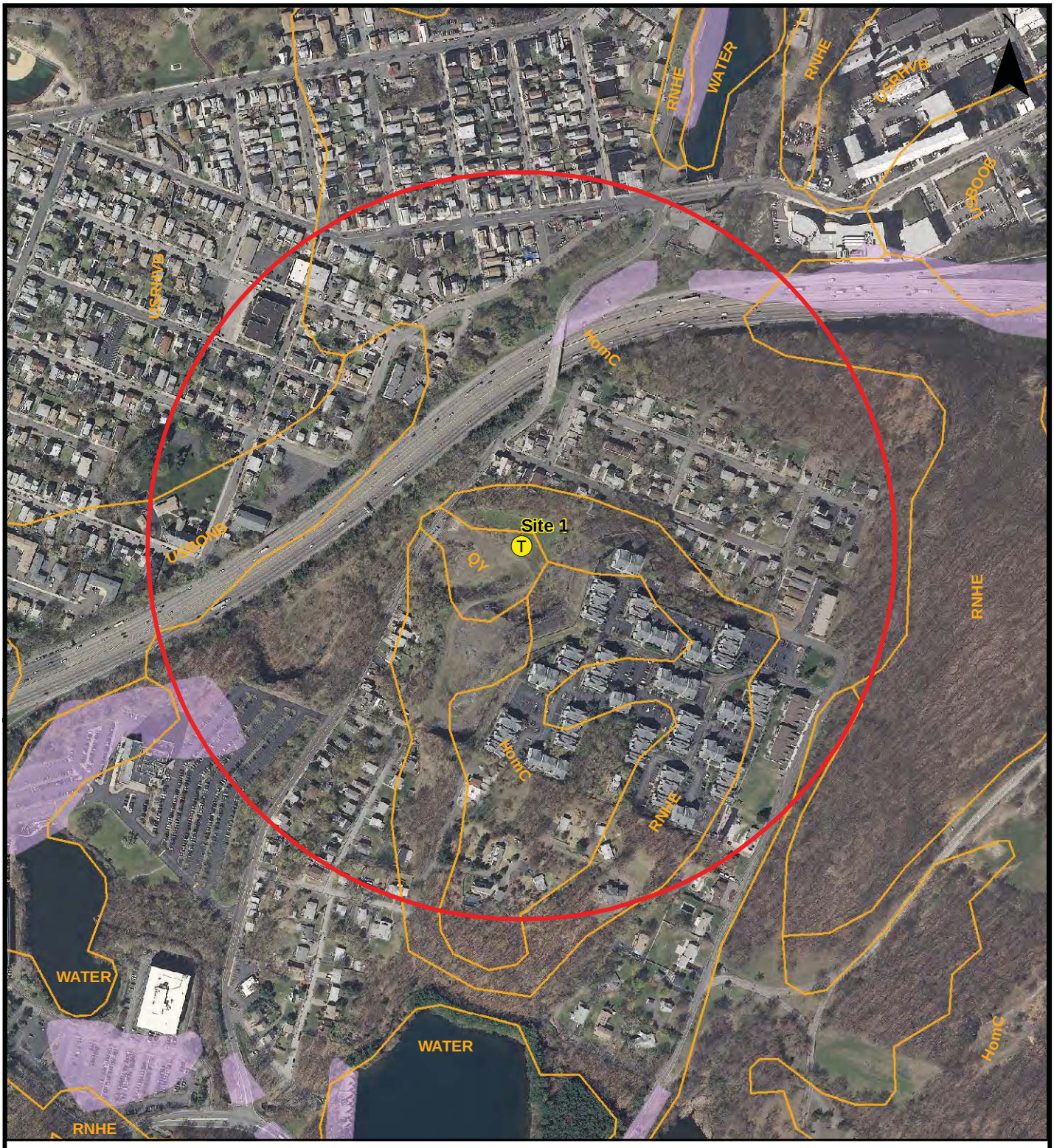

LEGEND

- T — Proposed Tank Site 1
- Project Area
- Areas of Historic Fill
- Passaic County Soils

BonBa—Boonton silt loam, stony, 3 to 8 percent slopes
HakBb - Haledon loam, very stony, 0 to 8 percent slopes
HomC - Holyoke-Map unit: rock outcrop complex, 3 to 15 percent slopes
RNHE - Rock outcrop-Holyoke complex, 15 to 45 percent slopes
USRHVB - Urban land-Riverhead complex, 3 to 8 percent slopes
USBONB - Urban land-Boonton complex, 0 to 8 percent slopes
USBONC - Urban land-Boonton complex, 8 to 15 percent slopes
QY - Quarry
WATER - Water

0 250 500 1,000 Feet

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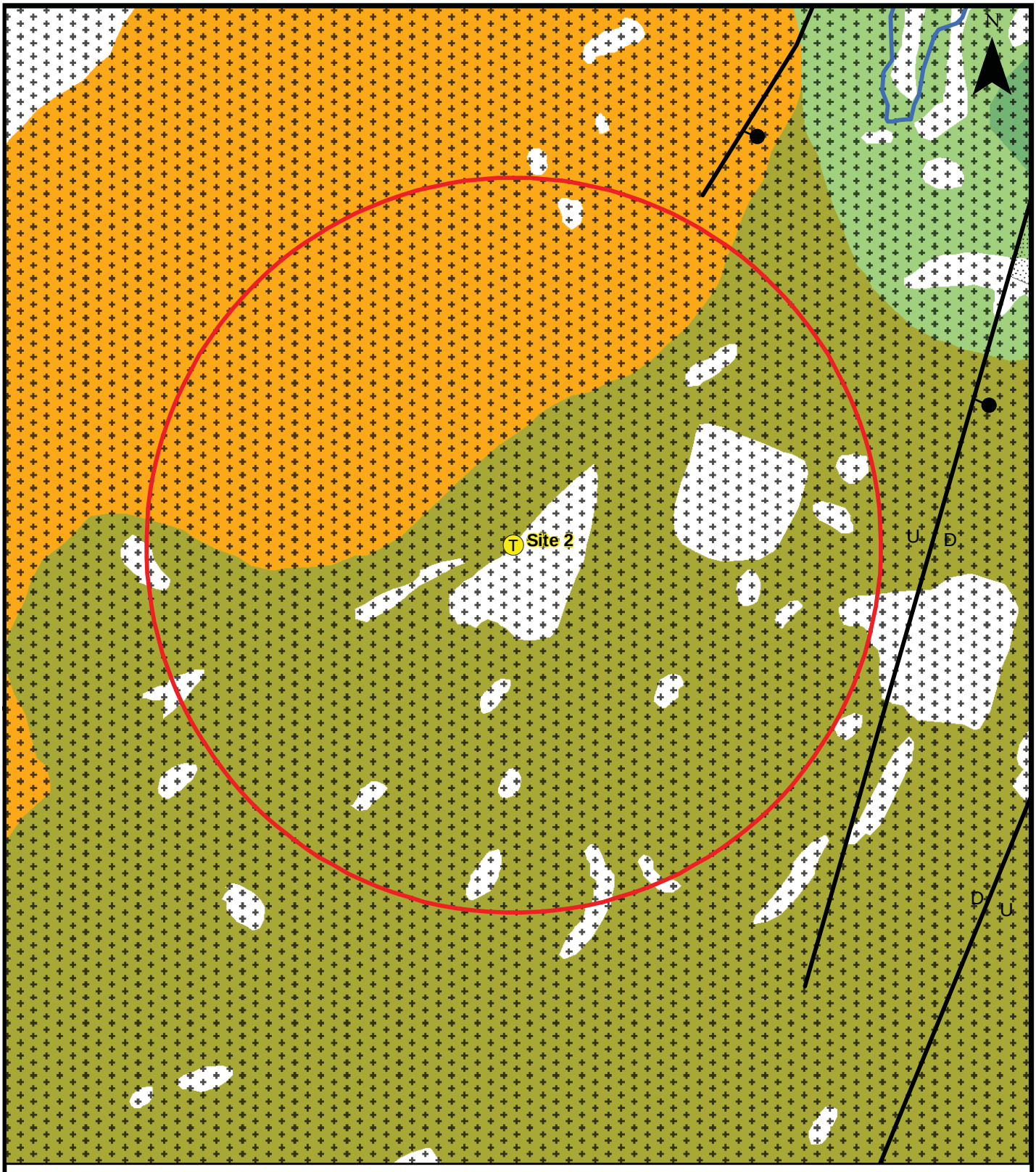
PASSAIC VALLEY WATER COMMISSION
LEVINE TANK SITE 1
PATERSON, NEW JERSEY

Figure 2-35: Site 1 Soils & Historic Fill

Designed	Drawn	Checked	Approved	Date
JMF	JMF			7/11/2014

Document Path: P:\306373\GIS\NJLevel2Review\Site 1\Figure 4 - Soils.mxd



Legend

- Proposed Tank Site 2
- Project Area
- Stanley Levine Reservoir

Bedrock Geology

- Orange Mountain Basalt *(Basalt Aquifer)*
- Passaic Formation Conglomerate and Sandstone facies *(Brunswick Aquifer)*
- Bedrock Fault *U, upthrown; D, downthrown. Ball shows direction of dip.*

Surficial Geology

- Glacial Lake Passaic, Great Notch stage, delta deposits
- Rahway till
- Rahway till, discontinuous
- Rahway till, yellow phase, discontinuous

0 250 500 1,000 Feet

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Iselin, New Jersey

PASSAIC VALLEY WATER COMMISSION
LEVINE TANK SITE 2
PATERSON, NEW JERSEY
Figure 2-36: Site 2
Bedrock & Surficial Geology

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LEGEND

- T — Proposed Tank Site 2
- Project Area
- Areas of Historic Fill
- Passaic County Soils

BonBa—Boonton silt loam, stony, 3 to 8 percent slopes
HakBb - Haledon loam, very stony, 0 to 8 percent slopes
HomC - Holyoke-Map unit: rock outcrop complex, 3 to 15 percent slopes
RNHE - Rock outcrop-Holyoke complex, 15 to 45 percent slopes
USRHVB - Urban land-Riverhead complex, 3 to 8 percent slopes
USBONB - Urban land-Boonton complex, 0 to 8 percent slopes
USBONC - Urban land-Boonton complex, 8 to 15 percent slopes
QY - Quarry
WATER - Water

0 250 500 1,000 Feet

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PASSAIC VALLEY WATER COMMISSION
LEVINE TANK SITE 2
PATERSON, NEW JERSEY
Figure 2-37: Site 2
Soils and Historic Fill

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For off-site tank inlet and outlets, any alignment within a 2 mile radius would have to be installed primarily through bedrock. It is assumed that connections to existing piping would be possible and would prevent the necessity of constructing alignments around Paterson Great Falls. Figures 2-38 and 2-39 present bedrock and surficial geology, and soils and historic fill, for Site 3.

2.8 Reservoir Decommissioning and Repurposing

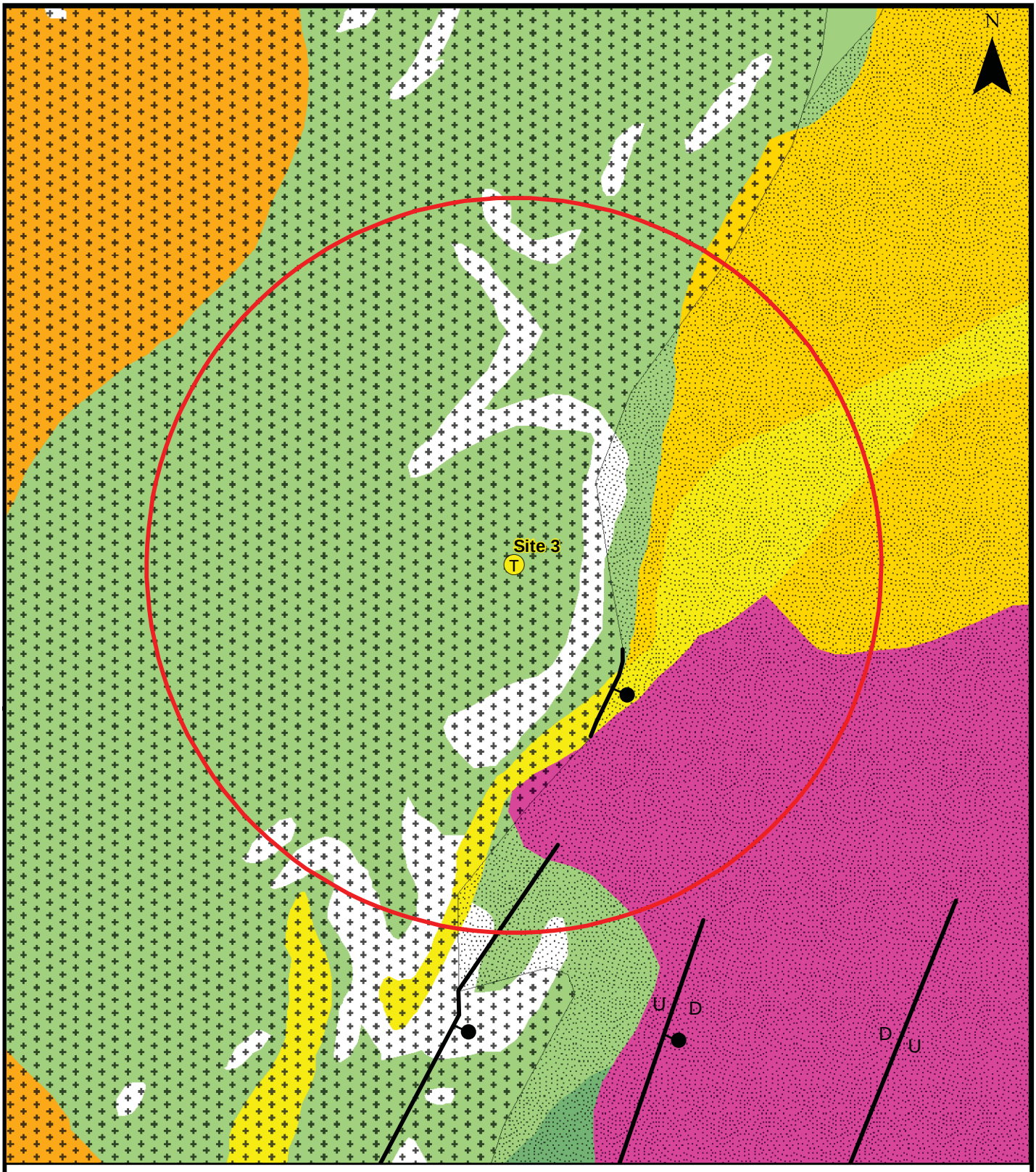
The Levine Reservoir will be decommissioned once the new tanks are placed in service. The proposed construction sequence of the Levine Reservoir tank includes draining the reservoir, constructing the tanks within the reservoir, and filling and grading the remainder of the site. Should the tanks be constructed elsewhere, maintenance of the reservoir will become a concern. Without the PVWC water supply flowing through the reservoir, the only water entering the reservoir would be from rainfall, and the reservoir would eventually become stagnant and vegetated.

If the reservoir were to remain a water body, it would need the capability to add fresh water, circulate the water, and drain excess water to prevent overflow. PVWC mains adjacent to the site could be tapped as a fresh water source, with backflow control to prevent reservoir water from entering the main. Pumps, with fountains or bubblers, would be needed for circulation. With the outlet structure sealed, the reservoir would have to overflow to the Passaic River as it does now. Drawbacks of this approach include: operating and maintenance costs for the pumping system, wasted water from overflowing the reservoir on a regular basis instead of only in emergencies, and environmental concerns with discharging the overflow into the Passaic River. The discharge will most likely require dechlorination facilities and a New Jersey Pollution Discharge Elimination Permit. The existing chlorination building could be converted to a dechlorination facility for this scenario.

2.9 Visual Impacts

The appearance of the tanks and aesthetic impacts to surrounding areas would be considered as part of the local planning board approval process and the various historic preservation reviews. For each of the three alternate sites, a viewshed analysis was conducted using site topography, to estimate the potential area within which the tanks may be visible. Note that the analysis results represent bare earth visibility only, and do not account for local obstructions such as buildings, trees, etc. The viewshed maps are presented as Figures 2-40, 2-41 and 2-42.

As another means of estimating visual impacts, renderings were developed from site photographs. The construction area of Site 2 is currently not visible from publicly accessible areas, so a rendering could not be developed for this site. Renderings for Sites 1 and 3 are presented below. For Site 1, the view selected was that from the homes located on the cliff above the site. For Site 2, the view selected was from the view of the Great Falls near the National Park office. As trees in full foliage would likely obscure the tank during the summer, a winter view was used for the rendering.



Legend

- T — Proposed Tank Site 3
- Project Area
- Stanley Levine Reservoir

Bedrock Geology

- Orange Mountain Basalt *(Basalt Aquifer)*
- Passaic Formation Conglomerate and Sandstone facies *(Brunswick Aquifer)*
- Bedrock Fault *U, upthrown; D, downthrown. Ball shows direction of dip.*

Surficial Geology

- Alluvium
- Glacial Lake Passaic, Great Notch stage, delta deposits
- Rahway till
- Rahway till, discontinuous
- Sandy Hill deposits, high stage
- Passaic Terrace deposit

0 250 500 1,000 Feet

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LEVINE TANK SITE 3
PATERSON, NEW JERSEY

Figure 2-38: Site 3
Bedrock and Surficial Geology

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JMF	JMF			7/10/2014

Document Path: P:\306373\GIS\NJLevel2Review\Site 3\Figure 3 - Geology.mxd

LEGEND

- T — Proposed Tank Site 3
- Project Area
- Areas of Historic Fill
- Passaic County Soils

HomC - Holyoke-Map unit: rock outcrop complex, 3 to 15 percent slopes
RNHE - Rock outcrop-Holyoke complex, 15 to 45 percent slopes
USRHVB - Urban land-Riverhead complex, 3 to 8 percent slopes
WATER - Water

0 250 500 1,000 Feet

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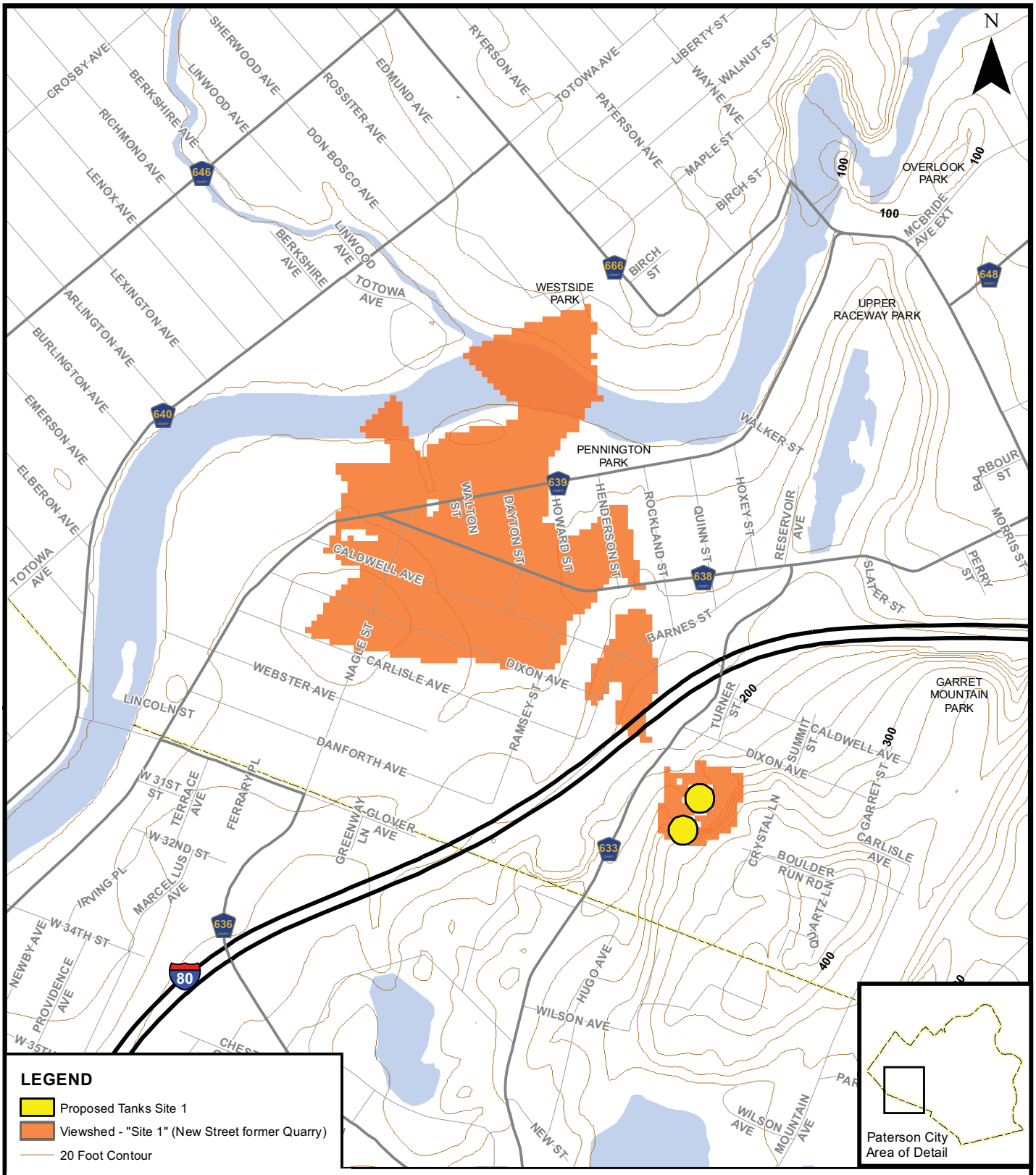
LEVINE TANK SITE 3
PATERSON, NEW JERSEY
Figure 2-39: Site 3
Soils and Historic Fill

Designed	Drawn	Checked	Approved	Date
JMF	JMF			7/11/2014

Document Path: P:\306373\GIS\NJLevel2Review\Site 3\Figure 4 - Soils.mxd



LEGEND

- Proposed Tanks Site 1
- Viewshed - "Site 1" (New Street former Quarry)
- 20 Foot Contour

NOTES:

1. Viewshed analysis assumed finished roof elevation of 239.5' for Tank Site 1.
2. Viewshed analysis was completed for 1/2 mile radius from tank location, at which distance a tank having a 10 ft height above the ground surface x 156 ft wide would have would have an angular size of 0.22 degrees (height) by 3.3 degrees (width).
   For comparison, an angular size of approximately 0.5 degrees has an apparent size that is"blockable" by holding up a single finger to the skyline, which corresponds to roughly the angular size of the moon.
3. Analysis results represent bare earth visibilty and do not account for local obstructions such as buildings, trees, etc.

0 375 750 1,500 Feet

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PASSAIC VALLEY WATER COMMISSION
LEVINE TANK SITE 1
PATERSON, NEW JERSEY
Figure 2-40: Site 1 Visibility

Designed	Drawn	Checked	Approved	Date
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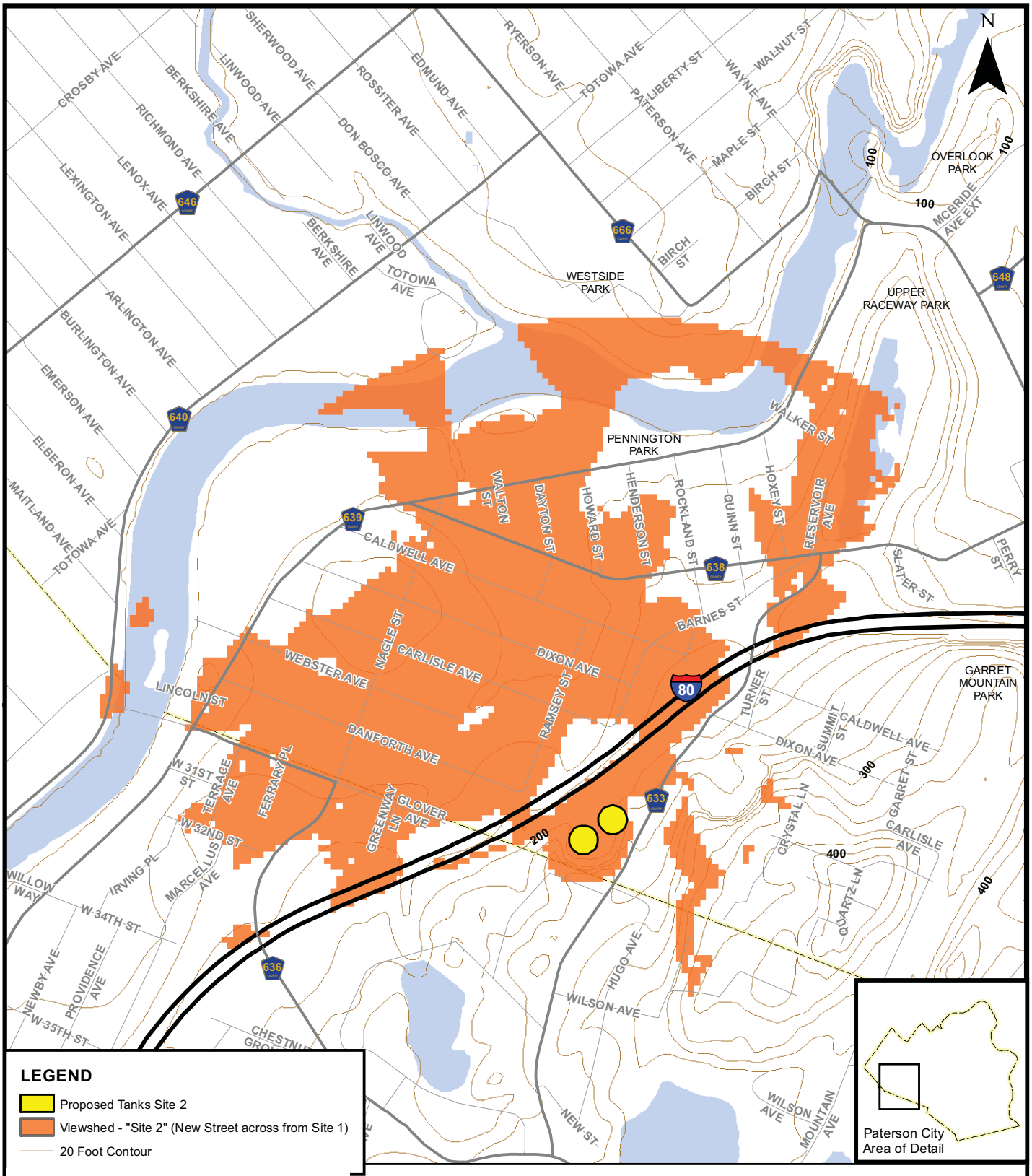
Document Path: P:\306373\GIS\NJLevel2Review\Site1\Figure 9 -Tank Visibility.mxd



NOTES:
1. Viewshed analysis assumed finished roof elevation of 239.5' for Tank Site 1.
2. Viewshed analysis was completed for 1/2 mile radius from tank location, at which distance a tank having a 10 ft height above the ground surface x 156 ft wide would have would have an angular size of 0.22 degrees (height) by 3.3 degrees (width).
For comparison, an angular size of approximately 0.5 degrees has an apparent size that is"blockable" by holding up a single finger to the skyline, which corresponds to roughly the angular size of the moon.
3. Analysis results represent bare earth visibilty and do not account for local obstructions such as buildings, trees, etc.

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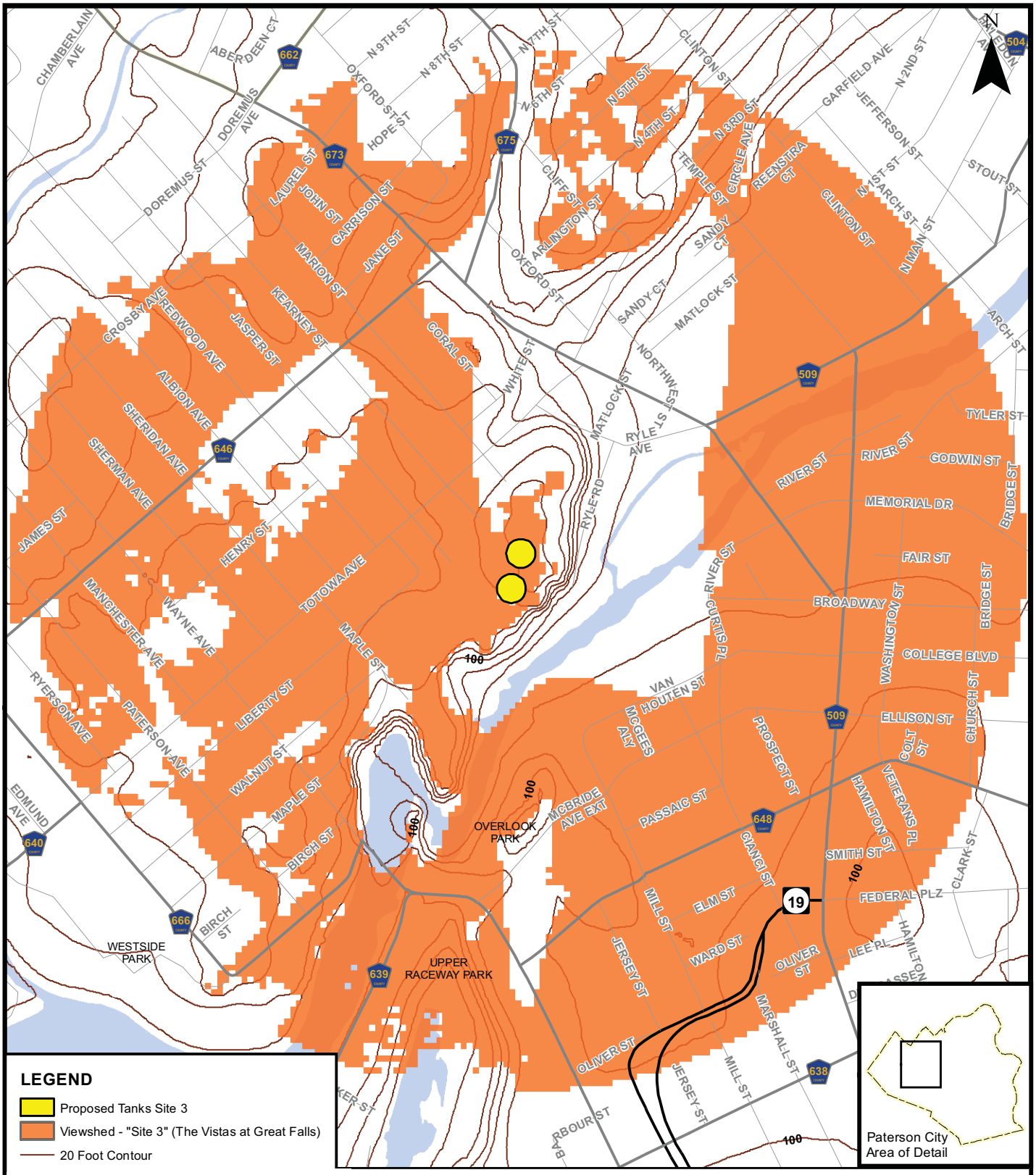
PASSAIC VALLEY WATER COMMISSION
LEVINE TANK SITE 2
PATERSON, NEW JERSEY
Figure 2-41: Site 2 Visibility

Designed	Drawn	Checked	Approved	Date
JMF	JMF			7/29/2014

Document Path: P:\306373\GIS\NJLevel2Review\Site 2\Figure 9 - Tank Visibility.mxd



NOTES:
1. Viewshed analysis assumed finished roof elevation of 239.5' for Tank Site 1.
2. Viewshed analysis was completed for 1/2 mile radius from tank location, at which distance a tank having a 10 ft height above the ground surface x 156 ft wide would have would have an angular size of 0.22 degrees (height) by 3.3 degrees (width).
For comparison, an angular size of approximately 0.5 degrees has an apparent size that is"blockable" by holding up a single finger to the skyline, which corresponds to roughly the angular size of the moon.
3. Analysis results represent bare earth visibilty and do not account for local obstructions such as buildings, trees, etc.

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PASSAIC VALLEY WATER COMMISSION
LEVINE TANK SITE 3
PATERSON, NEW JERSEY
Figure 2-42: Site 3 Tank Visibility

Designed	Drawn	Checked	Approved	Date
JMF	JMF			7/29/2014

Document Path: P:\306373\GIS\NJLevel2Review\Site 3\Figure 9 - Tank Visibility.mxd

Site 1 – Rendering With Proposed Tanks

Site 3 – Rendering With Proposed Tanks (Winter View)

SECTION 3

Engineering Estimate of Construction Costs

3.1 Methodology

An estimate of construction costs has been prepared for each of the alternative sites for the purpose of comparison to construction at the existing Levine Reservoir site. Estimates have been developed for Alternative Sites 1 and 2 for comparison purposes only, as these sites have been found to be infeasible for construction due to hydraulic and space constraints, as described in Section 2. Alternative Site 3 appears to be a feasible alternative to the Levine site considering only constructability and hydraulics.

The Levine Reservoir Preliminary Design Cost Estimate dated July 1, 2014, for construction at the original Levine Reservoir site was used as the basis for development of a common baseline for generating this comparative cost estimate. Site specific civil items which are unique to the Levine Reservoir Preliminary Final design were stripped out of the previous estimate to form a common baseline starting point.. Further there are common elements whose costs will remain constant for each of the sites, including the chemical building and the tanks. The following section presents the comparative cost results.

3.2 Comparison of Construction Costs

The following table provides a summary of costs for construction of the project at the original Levine Reservoir site and each of the three Alternative Sites developed in this report. Line items in the costs that are consistent among the four sites are the chemical building for chlorination and the prestressed concrete reservoirs. Each of the other line items have different needs and costs depending on the site.

Construction Cost Comparison of Levine Tanks Original Site vs Alternative Sites

Facility	Description	Original Site	Alt Site 1	Alt Site 2	Alt Site 3
1	General Conditions	637,743	1,393,111	1,388,369	1,384,678
6	Sitework/ Stormwater	3,926,522	3,649,268	4,494,585	5,075,096
7	Yard Piping	1,215,649	1,953,709	1,947,058	1,941,882
31	Chemical Building	1,569,822	1,569,822	1,569,822	1,569,822
56	Prestressed Concrete Reservoir	9,804,350	9,804,350	9,804,350	9,804,350
67	Inlet Pipe - Onsite	72,527	368,212	240,791	326,310
68	Inlet Pipe - Offsite	-	901,311	1,726,951	1,904,301
69	Outlet Pipe - Onsite	368,337	393,506	457,292	325,455
70	Outlet Pipe - Offsite	-	1,110,792	1,293,920	1,581,108
71	Tank Overflow - Onsite	101,211	272,353	370,027	206,895
72	Tank Overflow - Offsite	-	1,117,122	1,405,884	-
75	Highway 80 - Highway Crossing	-	1,522,202	1,517,019	-
76	Perimeter Fence - New	125,733	131,052	107,902	147,270
80	Rock Excavation and Disposal	844,292	13,283,779	7,796,148	7,775,423
	Total Construction Cost	$ 18,666,186	$ 37,470,589	$ 34,120,118	$ 32,042,590

The cost for inlet piping at the original site is markedly lower than the other sites, because of the ability to tie in to existing piping at the site. Off-site piping is not needed for the original site, while there are significant piping needs at the alternative sites, for both inlet and outlet piping. Similarly for the tank overflow, the Original site makes use of existing piping. Site 3 can accommodate the overflow in the stormwater detention basin. Sites 1 and 2 require offsite piping for the tank overflow.

Sites 1 and 2 also require microtunneling under Highway Route 80 for the inlet and outlet piping, which adds a cost of approximately $1.5 million to the project. Rock excavation at each of the sites varies greatly based on site elevations and topography, but is significantly higher than at the original site. The greatest excavation is needed at Site 1 because of the high and variable site elevations. This excavation results in costs approximately $6 million above Sites 2 and 3 and $12 million above the Original Site.

This cost estimate indicates a markedly higher construction costs at each of the alternative sites over the original site. Site 3, which was found to be technically feasible, has a cost that is approximately $14 million higher than the original location (approximately 80% higher cost). Even with that additional investment, decommissioning of the existing reservoir as outlined in Section 2.8 would still be needed, further adding to the overall cost. Sites 1 and 2 have even greater costs than Site 3, and more importantly, they are not technically feasible sites for construction.

Design of the facility at an alternate site would also incur additional engineering costs, including but not limited to performance of site-specific investigations such as soil borings, surveying and delineation of wetlands and flood hazard areas; design of off-site piping including special crossings; geotechnical engineering associated with significant rock excavation and slope stability concerns; redesign of stormwater management systems based on site topography and drainage; and preparation of new site-specific permits. If these costs are estimated at 10% of the incremental increase in construction cost of the alternate site compared to the Levine site, the resulting costs would be $1.3 to $1.9 million.

3.3 Cost Estimate Excluded Items

The following are excluded item from the estimate, based upon the limited design information:

1. Hazardous Remediation and Contaminated Soil or Water.
2. No Telemetry or SCADA is assumed to be required in addition to that already planned under the Levine design.
3. Crossings – No rail, aerial or water crossings are included in the estimate.
4. Decommissioning/ Repurposing the existing Levine Reservoir as a lake is not included in the estimate. Items that are likely to be needed include:
    - New 36-inch bypass pipe, external to reservoir, from inlet chamber to outlet chamber.
    - Demolition of outlet chamber
    - Modification of inlet chamber to continue functioning as lake overflow.
    - Water service connection with backflow prevention to provide one-way water supply into the lake
    - Floating Fountain Aerators
    - Bubble System for Aeration
    - Dechlorination station for lake overflow.
5. Costs associated with upgrading existing pumping and distribution systems to accommodate changed conditions.
6. Costs associated with land acquisition, including land purchase fees, legal costs and associated administrative expenses.
7. Costs associated with development of a Memorandum of Understanding with SHPO and design and implementation of any mitigation requirements established therein.

Project Schedule Impacts

4.1 Schedule Considerations

Under the original ACO, PVWC was required to submit completed design documents and all permit applications for the Levine Reservoir site by July 1, 2014. The ACO set further deadlines as follows:

- Within 180 calendar days of PVWC's receipt of all required permits and funding approvals, PVWC shall advertise for bids for the Levine Reservoir construction contract;
- Within 270 calendar days of PVWC's receipt of all required permits and funding approvals, PVWC shall award the Levine Reservoir construction contract;
- Within 60 calendar days of PVWC's awarding of the Levine Reservoir construction contract, PVWC shall initiate construction;
- Within 730 calendar days of the start of construction, PVWC shall substantially complete construction of the Levine Reservoir project.

The Amended ACO (AACO) extended the deadline for submittal of design documents and permit applications to October 1, 2014 to allow for completion of the Alternative Sites Evaluation. Should an alternate site be selected, PVWC is required to submit a revised construction schedule for the Levine Reservoir project to be incorporated into the AACO.

A schedule was prepared assuming completion of the Alternatives Analysis report by August 6, 2014. Under the revised schedule, presented as Figure 4-1, completion of construction at an alternate site would be completed in the Spring of 2019, approximately 1 year later than the anticipated completion date if the project were to proceed with the original site.

ID	Task Mode	Task Name	Duration	Start	Finish	Predecessors
1		Completion of Alternatives Analysis Evaluation	1 day	Wed 8/6/14	Wed 8/6/14	
2		Presentations to Public (2)	6 wks	Mon 8/25/14	Fri 10/3/14	
3		Land access negotiations for due diligence	1 mon	Mon 10/6/14	Fri 10/31/14	2
4		Due diligence investigations	2 mons	Mon 11/3/14	Fri 12/26/14	3
5		Land acquisition	6 mons	Mon 12/29/14	Fri 6/12/15	4
6		Site investigations for design	2 mons	Mon 6/15/15	Fri 8/7/15	5
7		DEP permitting coordination	4 mons	Mon 6/15/15	Fri 10/2/15	5
8		Design and permit applications	4 mons	Mon 8/10/15	Fri 11/27/15	5,6
9		Receipt of permit approvals (estimated)	6 mons	Mon 11/30/15	Fri 5/13/16	8
10		Bid advertisement no later than	130 days	Mon 5/16/16	Fri 11/11/16	9
11		Award construction contract no later than	195 days	Mon 5/16/16	Fri 2/10/17	9
12		Initiate construction no later than	45 days	Mon 2/13/17	Fri 4/14/17	11
13		Substantial completion of construction no later than	523 days	Mon 4/17/17	Wed 4/17/19	12

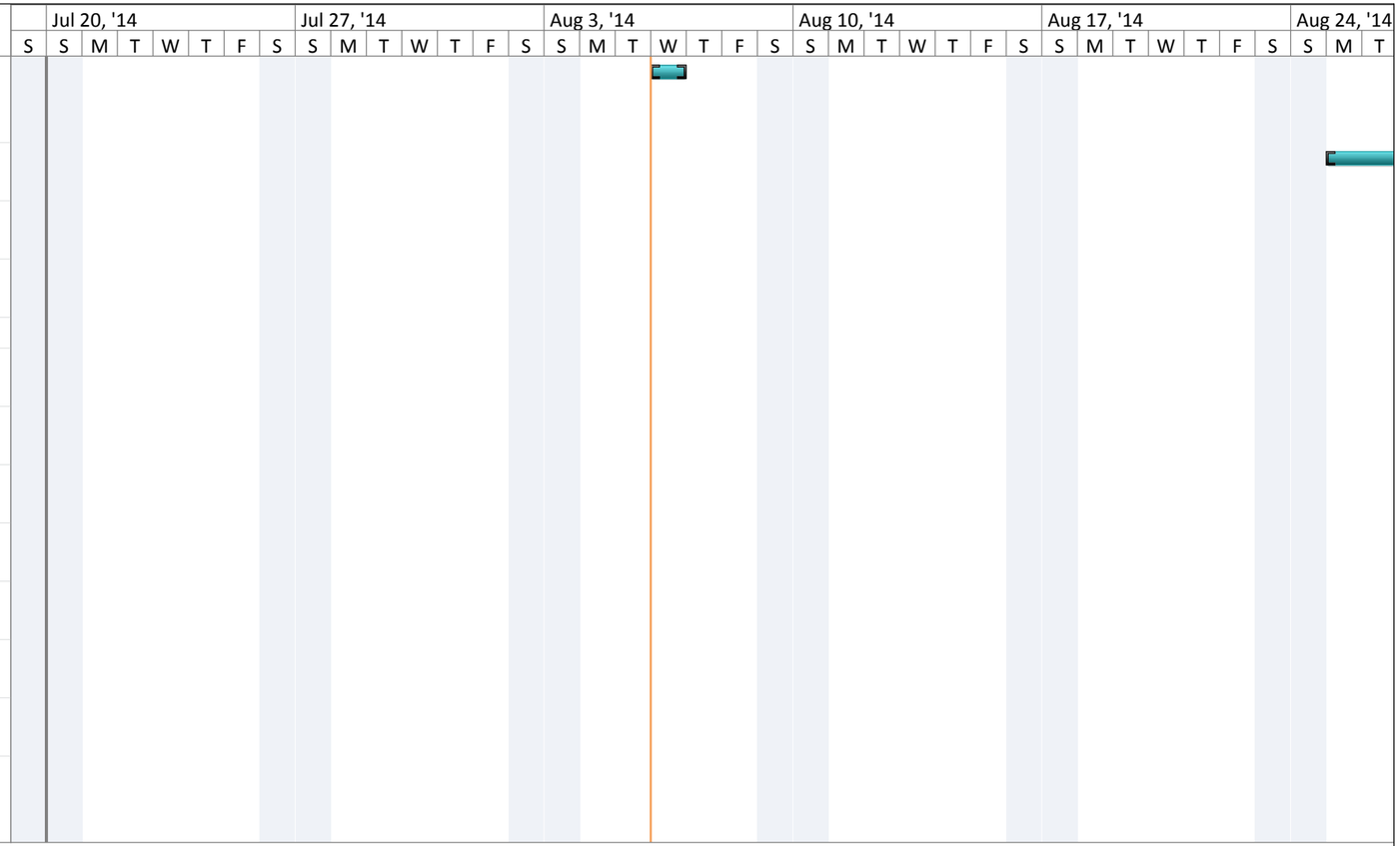

Figure 4-1: Project Schedule for Construction at Alternate Site

Project: Schedule 8-5-14.mpp
Date: Wed 8/6/14

Task	Project Summary	Inactive Milestone	Manual Summary Rollup	Deadline			
Split	External Tasks	Inactive Summary	Manual Summary	Progress			
Milestone	External Milestone	Manual Task	Start-only				
Summary	Inactive Task	Duration-only	Finish-only				

SECTION 5

Summary

5.1 Summary

Three sites have been proposed as potential alternate sites for the construction of two 2.5 MG pre-stressed concrete tanks and associated facilities to replace the existing Levine Reservoir:

Site 1: Block 5103 Lot 24, Paterson (former quarry on New Street)

Site 2: Block 5107 Lot 1, Paterson (across New Street from Site 1)

Site 3: Block 801, Lots 21 and 22, Paterson (formerly The Vistas at Great Falls)

An evaluation was conducted to review the feasibility of construction of the tanks at the alternate sites from an engineering standpoint, including constructability; compatibility with hydraulics of the existing system; environmental and land use constraints; permitting requirements; and cost and schedule considerations.

The findings of the evaluation are summarized in the following table and described below.

Site 1 was found to be technically infeasible due to the difference in elevation from the existing system and the potential for severe impacts on existing facilities due to the resulting increase in pressure. Site 1 also carried the highest construction cost of the sites, primarily due to extensive rock excavation that would be required at this site, very long runs of large diameter pipes that would be required to get water to and from the site, and tunneling under Rt. 80 which would be required in routing the pipelines.

Site 2 was found to be technically infeasible due to the size and configuration of the site, within which the required tanks, utility building, roads and stormwater management facilities could not be constructed, even with significant rock excavation. Construction at this site could also result in a potentially unacceptable increase in distribution system pressure. Site 2 also carried high construction costs due to extensive excavation, long runs of large diameter pipes and tunneling under Rt. 80.

Site 3 was found to be feasible based on engineering considerations alone, related to site size and configuration and compatibility with existing hydraulics. However, construction costs at this site are estimated to be approximately 170% higher than at the original Levine site, excluding land acquisition, legal, administrative and engineering fees associated with constructing the facility at alternate Site 3. Site 3 also is subject to State Historic Preservation Office approval, as is the original Levine site, and has the potential for visual impact to a much larger area than the original Levine site.

Summary of Evaluation Findings

Criteria	Levine	Site 1	Site 2	Site 3
Site size, topography and shape – adequate for construction of tanks, building, roads and stormwater system	Adequate	Appears adequate but with limitations; will require further investigation of capacity for stormwater management. Significant rock excavation required.	**Inadequate**	Adequate; significant rock excavation required.
Hydraulic elevation – compatible with 180 elevation	Compatible	**Incompatible – potential for distribution system damage**	**Incompatible – potential for distribution system damage**	Compatible
Proximity to PVWC system – is significant offsite piping required?	No significant offsite piping required.	**Significant offsite piping, including micro-tunneling under Interstate 80 and construction through rock**	**Significant offsite piping, including micro-tunneling under Interstate 80 and construction through rock**	Off-site piping required, through rock
Environmental regulatory constraints?	Potential Dam Safety concerns	Potential wetlands in construction area	Potential wetlands in construction area	Potential wetlands, not in construction area
Historic district/National Park Service impacts?	Yes. Possible contributing feature to Historic District.	To be determined, will require SHPO review	To be determined, will require SHPO review	Yes. Within Historic District and may be visible from Great Falls National Park overlook.
Zoning	Expected to be existing/permitted use	May require use variance	May require use variance	Expected to be permitted use
Maintenance of system operations during construction	Requires construction of temporary berm/reservoir during a very short shutdown period, and large reduction in available storage during construction	No special construction required to maintain operations	No special construction required to maintain operations	No special construction required to maintain operations
Estimated Construction Cost*	$ 18.7 million	$37.5 million	$34.1 million	$32.0 million

**excludes engineering, legal, administrative and land acquisition fees*