Newman Community Conservation Area Master Plan

Initial Study and Proposed Mitigated Negative Declaration

March 2021

APPENDIX E: NEWS Project Basis of Design Memorandum

Redtail Consulting
Environment & Community

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RICK ENGINEERING COMPANY

Memorandum

To: Eileen Alduenda (Council for Watershed Health)
Date: April 30, 2020
From: Hernan Cortez, Venkat Gummadi, Tom Martin, and Brendan Hastie
CC: Kathryn Reyes (City of Newman), Darla Elswick (Darla Elswick Consulting)

SUBJECT: CITY OF NEWMAN PROPOSITION 1 STORMWATER TECHNICAL ASSISTANCE – TASK 6.2 – PROJECT BASIS OF DESIGN AND FINAL STORMWATER QUALITY BENEFIT ANALYSIS (RICK J# 18529)

This memo provides a summary of the basis of design and design components that will require further refinement to finalize the design prior to construction for the proposed City of Newman Environmental Wetland System (NEWS) project.

This memo also provides a revised summary of storm water pollutant removals, and volume-based performance that may be achieved by the proposed stormwater wetland. The design and results presented in this memo supersede those presented as part of the Task 5.2 memo.

I BASIS OF DESIGN

I.1 <u>Design Selection Summary: Constructed Storm Water Treatment Wetland</u>

The project design was influenced by the City's goals and objectives as well as Proposition 1 Storm Water Implementation grant program eligibility and funding priorities. Objectives for project performance include storm and dry weather runoff treatment, groundwater augmentation, ecosystems and community. Through the preparation and development of Tasks 1 through 5, several types of stormwater management permanent structural Best Management Practices (BMPs) were considered, including vegetated swales, a regional wet pond, and a stormwater wetland. A series of desktop and field studies were conducted to facilitate the selection of the best BMP type and more importantly, check the feasibility of the project.

Through the field and desktop studies, existing potential jurisdictional wetland areas were observed sporadically throughout the project site, shallow groundwater was encountered, and constraints from existing storm drain infrastructure were identified. The potential jurisdictional wetland areas will require coordination with regional agencies such as the Regional Water Quality Control Board (RWQCB), the Army Corps of Engineers (ACOE), and Department of Fish and Wildlife (DFW) and potential processing of permits (401, 404, and 1602). The presence of shallow groundwater restricts the depth of the system and influences the type of BMP that is selected (i.e., adequate treatment of infiltrated storm water). Finally, the existing storm drain infrastructure constraints include vertical and routing constraints, which require the proposed site improvements to have a relatively flat slope (< 0.5% +/-) and make it difficult to bypass runoff from agricultural land due to comingling upstream of the project. Due to these existing site conditions and constraints, a constructed storm water treatment wetland was selected as the preferred design to meet project performance and multi-benefit objectives for the following reasons:

- The project would decrease pollutant loading to the San Joaquin River from urban and agricultural stormwater and dry weather flows;
- Addresses the State Trash Capture requirements (removing trash from the San Joaquin River);
- a storm water wetland would best mimic the historic natural watershed conditions and support any potential existing wetlands);
- would provide separation from the shallow groundwater at the micro pool using a clay liner;
- will function as desired given the elevation constraints to capture and convey storm water to manage both wet and dry weather runoff conditions from urban and agricultural land uses (see Attachment A for contributing Drainage Management Areas).
- storm water treatment wetland berms and operation and maintenance access can provide dual use as public access amenity;
- sufficient land, owned by the City, is available for a regional system with multiple constructed wetland components (e.g., sediment forebay, treatment ponds).
- Preserves open space and provides the City with the opportunity for future recreational enhancements for uses such as bike/walking paths and creating learning opportunities for the community tailored to stormwater.

The water quality treatment and hydrologic/hydraulic design are discussed in more detail below.

Water Quality Treatment Design: The NEWS project will achieve water quality treatment through diversion of dry (including agricultural returns) and wet weather flows into a constructed stormwater wetland which is comprised of three primary components. Attachment 2 shows the flow schematic and concept plan view exhibit.

- **Full Trash Capture Device and Sediment forebay**: Diverted flows will first be routed through a Full Trash Capture device (FTC) and sediment forebay. The FTC will remove trash and debris as small as 5 mm prior to discharging into the sediment Forebay to address the State Trash Amendment (STA) requirements for the City. The FTC and sediment forebay will reduce the amount of maintenance that is required for the downstream components. The sediment forebay will provide settling of suspended solids, sediment. This component also helps to concentrate maintenance activities. The sediment forebay is designed for a 48-hour drawdown time and includes three culverts (set at different elevations) to convey flows to the downstream stormwater wetland. The first (lowest elevation) culvert is designed to convey dry weather/nuisance flows, while the other two culverts discharge into the low- and high-marsh areas of the downstream stormwater wetland as the sediment forebay fills up. A low-marsh and high-marsh area are defined by the standing water depth within the stormwater wetland that supports emergent wetland vegetation. A low-marsh area has a standing water depth of 6- to 18-inches, while a High-marsh area has a standing water depth of 6-inches. The sediment forebay will also include an emergency overflow structure that is designed to safely convey a 100-year event (as required by the County of Stanislaus Standards and Specifications for similar facilities) to the downstream stormwater wetland.

  - A drawdown time of 24 hours to 96 hours is recommended in SE-2 (Sediment Basin) Factsheet (CASQA, 2011). The 24-hour limit is specified to provide adequate settling time and the 96-hour limit is specified to mitigate vector control issues.
  - Designed based on guidance from the New Jersey Stormwater Best Management Practices Manual (2004), the California Stormwater Quality Association (CASQA) Stormwater BMP Handbook (2003), and the Environmental Protection Agency's (EPA's) Storm Water Technology Fact Sheet (1999).

- **Constructed wetland**: Flows from the sediment forebay discharge to the constructed wetland basin through the proposed culverts or spillways (as described above) based on flow rate and volume entering the system to provide storm water treatment of urban and agricultural pollutants via physical, biological and biochemical processes. The constructed wetland is designed for a 72-hour drawdown time. The constructed wetland includes five culverts (all at the same elevation) to convey flows into the downstream micro pool. Stormwater flows will be routed into the stormwater wetland's low-marsh and/or high marsh areas prior to entering the micro pool based on the amount of inflow volume and flow rate. The wetland also includes an emergency overflow structure to safely convey the 100-year event to the micro pool (as required by the County of Stanislaus Standards and Specifications for similar facilities).
  - The County of Stanislaus post construction standards plan (County of Stanislaus, 2015) recommends the impounded water to be discharged within 72 hours to avoid vector breeding problems.
  - Design based on guidance from the New Jersey Stormwater Best Management Practices Manual (2004), the California Stormwater Quality Association (CASQA) Stormwater BMP Handbook (2003), and the Environmental Protection Agency's (EPA's) Storm Water Technology Fact Sheet (1999).
- **Micro pool**: Small runoff volumes (dry weather/nuisance flows) are routed from the sediment forebay to the stormwater wetland (via the lowest elevation culvert) and into the micro pool for treatment via a direct low-flow channel. The micro pool removes pollutants through both sedimentation, biological, and biochemical processes (e.g.,

settling, plant update, redox transformations). Sedimentation processes remove particulates, organic matter, and metals, while dissolved metals and nutrients are removed through biological uptake (USEPA, 1999). Higher stages in this basin will receive additional stormwater quality treatment through extended detention and/or attenuation of the peak rates of runoff. The permanent micro pool is designed to have a 3-day hydraulic residence time (time it takes for water entering the micro pool to reach the outlet). The presence of a year-round base flow and replacement of water in the micro pool assists with water quality, oxygen levels, control of mosquito breeding, and prevents stagnation. The extended detention portion of the basin is designed for a 72-hour drawdown time. The micro pool also includes an overflow structure is designed to safely convey the 100-year storm back to the Miller Ditch (as required by the County of Stanislaus Standards and Specifications for similar facilities).

- The County of Stanislaus post construction standards plan (County of Stanislaus, 2015) recommends the impounded water to be discharged within 72 hours to avoid vector breeding problems.
- Design based on guidance from the New Jersey Stormwater Best Management Practices Manual (2004), the California Stormwater Quality Association (CASQA) Stormwater BMP Handbook (2003), and the Environmental Protection Agency's (EPA's) Storm Water Technology Fact Sheet (1999).

The diversion into the system, flow routing between basins, and discharge back to Miller Ditch will be driven by gravity flow. Pumping will be necessary to empty the permanent micro pool for maintenance purposes.

Hydrologic/Hydraulic Operation: The Newman Environmental Wetland System will operate differently during dry and wet weather flow regimes.

- **Dry Weather**: Flows diverted from Miller Ditch during dry weather will be routed through the sediment forebay, the wetland area and then the micro pool via a low-flow channel. The micro pool is designed to have a 3-day hydraulic residence time. Hydraulic residence time is the average time a dry weather water drop remains within the permanent micro pool receiving treatment. The Dry weather flow was assumed to have a flow rate of 0.9 cfs based on the capacity of the low-flow pump within the existing storm drain pump station (see Section II.3.2 for more information on dry weather flow). The micro pool provides approximately 5.4 acre-feet storage below a 74.5' elevation (elevation of the outlet pipe).
- **Wet Weather**: Wet weather flows will be diverted from the Miller Ditch to the sediment forebay. Flows from the sediment forebay will then be discharged to the constructed wetland through three different outlet structures at different inverts (elevations of 75',

76', and 77'. These multistage outlets are intended to activate different portions of the wetland area based on the rainfall amount to facilitate formation of low marsh and high marsh zones. Flows from the constructed wetland are then discharged to the Miller Ditch via the permanent micro pool.

II STORMWATER WETLANDS DESIGN AND MODEL REFINEMENTS

The Project design provides water quality treatment to reduce pollutant loads to the San Joaquin River. Additionally, the project will support groundwater quality and quantity through partial infiltration of treated runoff. Project water quality benefits were estimated based on continuous simulation model analyses, which are described below.

II.1 Analysis Approach

The stormwater pollutant load and volume reductions were estimated utilizing the proprietary software PCSWMM (version 7.2), distributed by Computational Hydraulics International (CHI). PCSWMM utilizes the non-proprietary Environmental Protection Agency Stormwater Management Model (EPA SWMM) Version 5 engine (SWMM5). EPA SWMM has the capability to simulate rainfall and runoff processes utilizing long-term rain gage data coupled with pollutant buildup/wash-off processes, infiltration, evapotranspiration, as well as pollutant treatment and removal. PCSWMM is used throughout the United States to provide estimates of pollutant reductions achieved by storm water projects including constructed storm water treatment wetlands.

Relevant data sources were reviewed to support the estimation of water quality treatment benefits including:

- National Stormwater Quality Database Version 4.02 (Maestre & Pitt, 2018)
    - Pollutant EMCs by Land Use
- Paired influent and effluent date from the 2016 version of the International Stormwater BMP Database 2016 (http://bmpdatabase.org/)
    - BMP Pollutant Reduction Performance
- National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information (NCEI) Climate Data Online
    - Rain Station Precipitation Data
- California State Water Resources Control Board (SWRCB)
    - 303(d) Listed Water Bodies
- California Irrigation Management Information System (CIMIS)
    - Evapotranspiration rates

The Newman Wasteway is the receiving water directly downstream from the project site and is listed on the 2014-2016 statewide 303(d) list. The pollutant, category, and potential source of the pollutant for the Newman Wasteway as provided by the 303(d) list are listed within Table 1 for reference purposes. The Newman Wasteway discharges to the San Joaquin River, which is listed by the Water Board for beneficial uses including municipal, agriculture and aquatic resources.

Table 1. 2014-2016 California 303(d) Listed Waterbodies and Associated Pollutants

WATER BODY NAME	POLLUTANT	POLLUTANT CATEGORY	POTENTIAL SOURCES
Newman Wasteway	Simazine	Pesticides	Source Unknown
	Salinity	Salinity	Source Unknown
	Oxygen, Dissolved	Nutrients	Source Unknown
	Indicator Bacteria	Fecal Indicator Bacteria	Source Unknown
	Chlorpyrifos	Pesticides	Agriculture
	DDE (Dichlorodiphenyldichloroethylene)	Pesticides	Source Unknown

The Newman Environmental Wetland System is anticipated to reduce the pollutants listed in Table 1 before discharging to the Newman Wasteway. The pollutant concentrations and wetland performance data are not readily available for majority of the pollutants under Table 1 (except for Fecal Indicator Bacteria – such as fecal coliform) so these pollutant reductions are not explicitly quantified. The pollutants which were quantified in the modeling efforts consist of the following urban and agricultural land use pollutants:

- Fecal Indicator Bacteria: Fecal Coliform (FC)
- Metals: Copper (Cu); Lead (Pb); Zinc (Zn)
- Nutrients: Nitrites + Nitrates (NO_2 + NO_3); Total Phosphorus (TP)
- Sediment: Total Suspended Solids (TSS)

Event mean concentrations (EMCs) for these pollutants for different land uses were obtained from the National Stormwater Quality Database (NSQD) and the pollutant reduction data were developed using the influent/effluent data from the International Stormwater BMP Database. This data was then used to build the continuous simulation model in PCSWMM. The long-term continuous simulation results obtained from the modeling software were analyzed to aggregate pollutant inflows and outflows for individual water years (October 1 to September 30), to estimate an average annual pollutant reduction.

II.2 <u>Watershed and Land Use</u>

Drainage area delineations completed in a previous task were reviewed and revised to more closely match existing drainage patterns. This effort assisted in distinguishing areas draining to the project including flows from the existing storm drain pump station located at the intersection of Inyo Avenue and Canal School Road, and from areas draining via gravity flow to the location of Miller Ditch immediately upstream of the proposed wetlands. Storm drain maps from Master Drainage Plan prepared by Doyle were used to identify storm drains connected to Inyo Avenue

Storm Drain Pump Station. The drainage areas to the Newman Environmental Wetland System are shown in Attachment A. The existing land use breakdown is presented in Table 2.

It should be noted that two scenarios are presented below in Table 2 due to the possibility of UC Merced developing a project that will manage runoff from DMA South. The “long term” scenario assumes the UC Merced project gets constructed and the DMA South gets bypassed from this project. The “short term” scenario assumes the UC Merced project has not been built and that all three DMAs (DMA North, DMA Central, DMA South) are routed through this project. Both scenarios are presented due to the uncertainty of the UC Merced project schedule.

Table 2: Existing Land Use Composition

Land Use	Long-term DMA: DMA North + DMA Central			Short-term DMA: DMA North + DMA Central + DMA South		
	Area (acres)	% Total Area	% Impervious	Area (acres)	% Total Area	% Impervious
Urban Land Uses	1,151	51%	73%	1,390	44%	74%
Agriculture	1,090	49%	0%	1,804	56%	0%
Total Drainage Area	**2,241**	**-**	**38%**	**3,194**	**-**	**32%**

Land Use		DMA North		DMA Central		DMA South	
		Area (acres)	% Impervious	Area (acres)	% Impervious	Area (acres)	% Impervious
Urban Land Uses		485	72%	666	74%	239	81%
Urban Land Use Categories	Commercial	0	-	53	-	25	-
	Industrial	13	-	80	-	40	-
	Transportation	146	-	185	-	63	-
	Open Space	47	-	84	-	9	-
	Single Family Residential	254	-	199	-	83	-
	Multi-Family Residential	24	-	64	-	20	-
Agriculture		620	0%	471	0%	714	0%
TOTAL		**1,105**	**31%**	**1,136**	**44%**	**953**	**20%**

II.3 Hydrology

II.3.1 Rainfall Data

Hourly rainfall data was obtained from the NOAA NCEI Climate Data Online Map Server. The nearest rain station to the project location with the longest period of record is located in the City of Modesto (MODESTO 2 CA US), approximately 20 miles north of the City of Newman. The rainfall record ranges from July 1, 1948 to December 7, 2013. For modeling purposes, 65 complete water years from October 1, 1948 to September 30, 2013 (Water Years 1949 to 2013) were incorporated into the continuous simulation model.

The raw hourly data was pre-processed to remove missing values, and long accumulation periods (i.e. 1 month). The revised rainfall data was input as a Rain Gage time-series component in PCSWMM to simulate the delivery of rainfall over the drainage areas tributary to the project study area. The average annual rainfall for the Rain Gage is 11.0 inches. Table 3 summarizes the total rainfall depths recorded at the Modesto Rain Station per water year.

Table 3: Modesto Rain Station – Total Precipitation by Water Year

Water Year	Rain (in.)	Water Year	Rain (in.)	Water Year	Rain (in.)	Water Year	Rain (in.)
1949	8.04	1966	9.03	1983	10.20	2000	16.30
1950	9.92	1967	13.73	1984	7.70	2001	11.60
1951	12.48	1968	7.91	1985	6.50	2002	11.00
1952	14.39	1969	17.49	1986	16.50	2003	8.10
1953	7.95	1970	9.23	1987	8.20	2004	5.20
1954	7.20	1971	11.84	1988	9.00	2005	12.80
1955	11.22	1972	6.52	1989	7.90	2006	13.70
1956	13.45	1973	18.00	1990	9.30	2007	7.90
1957	7.22	1974	15.60	1991	9.50	2008	9.80
1958	18.27	1975	12.00	1992	11.70	2009	7.40
1959	8.47	1976	6.40	1993	18.70	2010	14.10
1960	5.36	1977	6.50	1994	10.10	2011	8.80
1961	7.79	1978	19.10	1995	19.90	2012	7.70
1962	10.56	1979	8.10	1996	10.20	2013	8.90
1963	12.44	1980	14.80	1997	14.10	-	-
1964	8.11	1981	9.30	1998	25.50	-	-
1965	10.60	1982	16.80	1999	10.80	-	-

The typical approach for post construction BMPs is treat the 85th percentile, 24-hour storm event (85th percentile). Therefore, a single-storm event scenario comprised of the 85th percentile precipitation depth was modeled using a Soil Conservation Service (SCS) Type I storm distribution within the SWMM Software. A precipitation depth of 0.49 inches was used for the 85th percentile. This depth was obtained from the Caltrans Basin Sizer program.

II.3.2 Baseflow

A baseflow of 0.9 cfs (1.8 acre-feet/day) has been incorporated into the model to represent dry weather/agricultural tailwater conditions. This flow rate was based on review of as-built drawings of the Inyo Avenue storm drain pump station (part of the "Woodside Homes Storm and Sewer Water Lift Stations: Lucas Ranch II" plan set, dated July 3, 2001). The drawings show a low-flow "nuisance" (non-stormwater or low-flows) pump with a capacity of 400 gallons per minute (approximately 0.9 cfs) to convey dry-weather nuisance flows present in the storm drain system.

II.3.3 Evapotranspiration Data

Monthly average evapotranspiration data was obtained from the CIMIS Reference Evapotranspiration Zones data available from the California Department of Water Resources. The project study area is located within Evapotranspiration Zone 14 in the State of California. Table 4 summarizes the monthly average evapotranspiration rates utilized in the PCSWMM model continuous simulation:

Table 4: Average Monthly Evapotranspiration Rates (inches/day)

Zone	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
14	0.05	0.08	0.12	0.17	0.22	0.26	0.28	0.25	0.19	0.13	0.07	0.05

II.4 Grading and Storage Volume

A stage-storage relationship was developed from the grading contours and included in the model to represent surface ponding, evapotranspiration, and flow attenuation that may occur as stormwater runoff is discharged into the Newman Environmental Wetland System. The stage-storage relationship is described in the model utilizing storage nodes with an assigned volume rating curve.

The project site has flat topography with short vertical fall within study area. In order to have gravity flow for the diversion, flow routing between basins, and discharge back to Miller Ditch shallow depths and conveyance connections were proposed.

Based on a boring performed at the project site (per the Infiltration Test Results report prepared by Technicon, dated June 3, 2019), it was assumed the groundwater table is at elevation 71.5'. Additional groundwater data was obtained from piezometers installed on April 15th, 2020 by ENGEO Inc. Based on the piezometer readings on April 15th, the groundwater elevation at the proposed location of the micro pool is at approximately an elevation of 70.0'. The bottom elevation of the micro pool is proposed to be at 72', therefore, providing an approximate 2.0 feet separation. It is recommended that a clay liner be installed at the bottom of the micro pool to maintain a permanent pool of water as well as to reduce potential contamination of groundwater. Based on standard engineering practice for designing BMPs, the unlined portions of the NEWS project (sediment forebay and wetland area) will have more than 3 feet of separation to sufficiently protect the underlying groundwater. The NEWS project incorporates pretreatment via a sediment forebay which will further reduce the potential for groundwater contamination (Clark and Pitt, 2007). The vertical elevations for different cells may need to be refined as part of the detailed design once additional groundwater measurements are available for the study area. Table 5 summarizes the stage-storage relationship utilized in the continuous simulation model. Table 6 provides a summary of total volume and a range of elevations for each system component.

Table 5: Stage-Storage Relationship for Wetland Design Concept

	Sediment Forebay		**Constructed Wetland**		**Micro pool**		**Total System**	
Elevation	**Area**	**Volume**	**Area**	**Volume**	**Area**	**Volume**	**Area**	**Volume**
(FT)	*(SF)*	*(AC-FT)*	*(SF)*	*(AC-FT)*	*(SF)*	*(AC-FT)*	*(SF)*	*(AC-FT)*
72	-	-	-	-	92,772	-	92,772	-
73	-	-	-	-	97,467	2.18	97,467	2.18
74	-	-	-	-	102,222	4.48	102,222	4.48
74.5	-	-	-	-	*104,572*	5.66	206,085	5.66
75	*35,971*	-	167,056	-	107,037	6.88	310,064	6.88
76	*80,878*	1.34	291,161	5.26	111,912	9.39	483,951	15.99
77	*106,941*	3.50	362,529	12.76	116,846	12.02	586,317	28.28
78[1]	120,451	6.11	374,880	21.23	121,841	14.76	617,172	42.09
79	127,452	8.95	387,409	29.98	126,896	17.61	641,757	56.54
80	137,053	11.99	405,329	39.08	134,559	20.61	676,941	71.68

1. The overflow/bypass spillway elevation is set at 78; therefore, the provided static storage volume for all three cells combined is 42.1 AC-FT. The elevation of the access berm/road is approximately elevation 80. With a target freeboard of 1 foot, the design provides 1 foot for bypass/overflow during larger storm events.

Table 6: Storage Summary for Wetland Design

BMP Component	**Storage at WQ Depth**	**Elevation Ranges**	**Water Quality Depth**		**Depth to Top of Berm**
			Dry Weather[2]	**Wet Weather**	
Sediment Forebay	6.11 acre-feet	75’ to 78’	N/A	3 feet	5 feet
Constructed Wetland	21.23 acre-feet	75’ to 78’	N/A	3 feet	5 feet
Micro Pool	14.76 acre-feet[1]	72’ to 74.5’ (Dry Weather) 72’ to 78’ (Wet Weather)	2.5 feet	6 feet	8 feet

1. Dry weather permanent pool storage is 5.66 acre-feet. The remaining storage of 9.1 acre-feet is for wet weather.
2. Dry weather conditions are designed to flow from the sediment forebay, through the wetland area, and into the micro-pool through a low-flow channel. The micro pool is designed to provide a permanent 2.5 ft ponding depth and to allow a flow-through condition for dry weather flows as described in the previous sections.

II.5 <u>Hydraulics</u>

II.5.1 Facility Sizing: Flow and Volume Design Performance

For volumetric best management practices (BMPs), the Phase II Municipal Separate Storm Sewer System (MS4) permit (2013) and the County of Stanislaus post construction standards plan

(County of Stanislaus, 2015) requires the BMPs be sized to meet at least one of the following volumetric hydraulic sizing design criteria.

- The maximized capture storm water volume for the tributary area, on the basis of historical rainfall records, determined using the formula and volume capture coefficients in the Urban Runoff Quality Management, Water Environment Federation (WEF) Manual of Practice No. 23/ASCE Manual of Practice No. 87 (1998) pages 175-178 (that is, approximately the 85th percentile runoff event); or
- The volume of annual runoff required to achieve 80 percent or more capture, determined in accordance with the methodology in Section 5 of CASQA's Stormwater Best Management Practice Handbook, New Development and Redevelopment (2003), using local rainfall data.

These sizing criteria are consistent with the Phase II MS4 permit for storm water quality compliance for post-construction requirements. Based on the modeling results, the 85th percentile runoff total for Newman DMA and North Ag DMA (Scenario 1) is 31.9 acre-feet and for all contributing DMAs (Scenario 2) is 39.9 acre-feet. The static storage provided below the overflow elevation for all three BMP components combined is 42.1 acre-feet. In addition, a target diversion flow rate of 50 cubic feet per second is selected, which results in 80 percent capture of storm water runoff from all contributing DMAs (Scenario 2) so the second design criteria is also met (see Figure 3). The target diversion rate of 50 cubic feet per second will result in 85 percent capture of storm water runoff from Newman DMA and North Ag DMA (Scenario 1).

A 6'W x 2'H reinforced concrete box (RCB) from the Miller Ditch to the sediment forebay with a 2' headwall across the Miller Ditch will result in a diversion of 50 cubic feet per second or greater. See Figure 1 below for the volume captured to diversion rate relationship for the project.

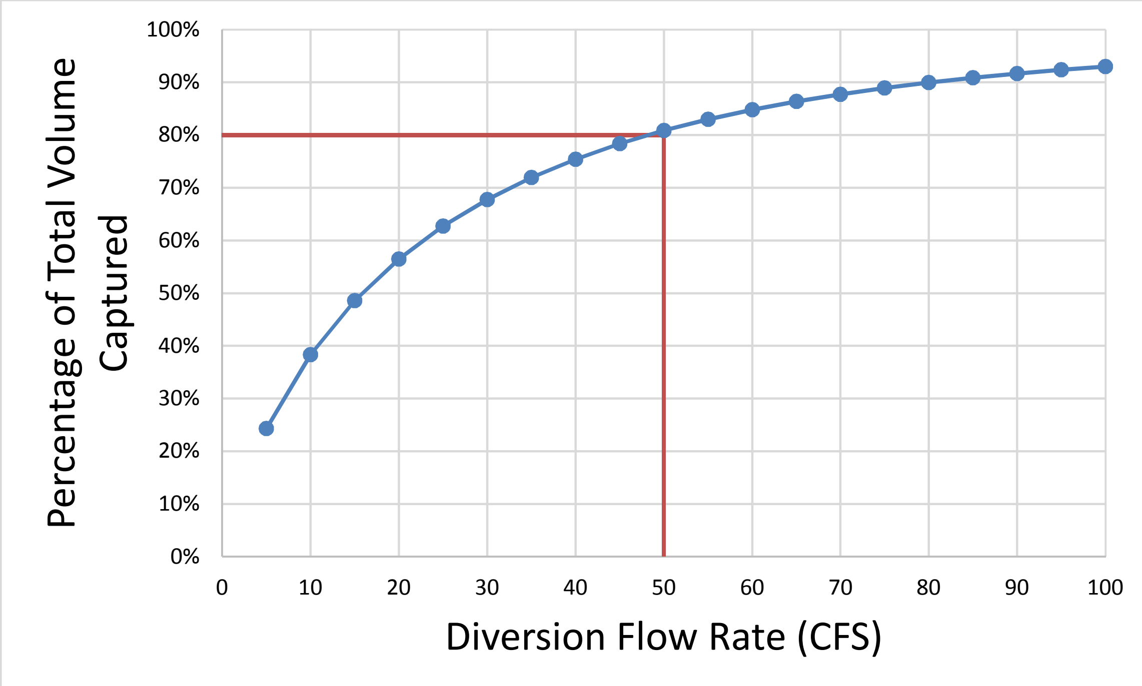

Figure 1: Flow Diversion Sensitivity Analysis for all contributing DMAs (Scenario 2)

II.5.2 Sediment Forebay

The sediment forebay outlets structures are designed to have 48-hour drawdown time and to safely convey a 100-year event to the downstream components. Four different outlet structures are designed to activate different portions of the wetland area based on the rainfall amount to facilitate formation of low marsh and high marsh zones. The low flow restrictor outlet, which is the closest to the inflow of the sediment forebay, is designed to convey the dry weather/agriculture tailwater flow rates. This is done to reduce short-circuiting of wet weather flows through the micro pool. The flows through the low flow restrictor outlet discharge to the micro pool via a low flow channel in the constructed wetland. Each subsequent outlet in the sediment forebay allows routing to low and high marsh areas of the constructed wetland pond, respectively. The proposed outlet structures in the sediment forebay are summarized below (approved equivalents may be used):

- Low-Flow Restrictor: 1'W x 0.25'H Rectangular notch (FL 75');
- Mid-Flow Outlet: Grated Catch Basin (Caltrans D77B, Type 24-13) (FL 76');
- High-Flow Outlet: Triple Grated Catch Basin (FL 77') (Caltrans D77B, Type 24-13); and
- Overflow Spillway: 195'W x 2'H (FL 78').

It is recommended that a portion of the sediment forebay include a concrete pad to facilitate maintenance. No infiltration losses are assumed for the sediment forebay area due to sediment loading; however, evapotranspiration benefits were quantified for this area.

II.5.3 Constructed Wetland

The constructed wetland outlet pipes are designed so they do not restrict flows to the micro pool and the overflow spillway is designed to safely convey the 100-year event to the micro pool. The drawdown within the constructed wetland is regulated using the outlet structures in the micro pool. The proposed outlet structures in the constructed wetland area are summarized below (approved equivalents may be used)::

- 6 – 48" RCP (FL 74); and
- Overflow Spillway: 195'W x 2'H (FL 78).

The measured infiltration was obtained from the geotechnical letter report prepared by Technicon Engineering Services, Inc. in support of the Proposition 1 Technical Assistance for the City of Newman titled, "Newman LID Project NEC Braza Road & Canal School Road, Newman, California – Infiltration Test Results," and dated June 3, 2019. Infiltration test "DR-3" was determined to be the limiting infiltration rate result located within the footprint of the proposed stormwater wetland with an observed infiltration rate of 0.25 inches per hour (in/hr.). Since shallow groundwater table is anticipated, conservatively a factor of safety of 5 was applied to the observed infiltration rate. The design "seepage" modeling component of 0.05 in/hr. was used to represent a uniform infiltration rate across the footprint of the constructed wetland cell. As additional groundwater measurements and geotechnical information becomes available it is recommended that this assumption be revisited as part of the final design. Evapotranspiration benefits were quantified for this area.

II.5.4 Micro Pool

The permanent micro pool volume is designed to have a 3-day hydraulic residence time (dry weather flow rate of 0.9 cfs; >5.36 acre-feet storage below 74.5' elevation). The outlet structures for the permanent micro pool are designed to support a 72-hour drawdown time and safely convey a 100-year event. It is recommended that a clay liner be installed at the bottom of the micro pool to maintain a permanent pool of water as well as to reduce potential contamination of groundwater. The proposed outlet structures are summarized below (approved equivalents may be used)::

- Storage below FL 74.5' = 5.66 acre-feet (> 5.36 acre-feet required to have a hydraulic residence time of 3 days);
- 3.5'W x 0.25'H Rectangular notch (FL 74.5');
- 0.6'W x 0.25'H Rectangular notch (FL 76.5');
- Grated Catch Basin (FL 77.25') (Caltrans D77B, Type 24-13); and
- Overflow Spillway: 195'W x 2'H (FL 78)

No infiltration losses are assumed for the permanent micro pool area. Evapotranspiration benefits were quantified for this area.

II.6 Pollutant Loading and Removal Estimate

II.6.1 Pollutant Loading Rates Data – Event Mean Concentrations (EMCs) by Land Use

To account for pollutant loading rates from the tributary drainage areas, Event Mean Concentration (EMC) data documented in the latest National Stormwater Quality Database Version 4.02 (NSQD V4.02) was assigned to individual urban land uses within the tributary drainage area and incorporated into the SWMM model. The aggregate concentration of pollutants present in stormwater runoff from the tributary drainage area is calculated by the SWMM program, with consideration of the total of individual land uses present within the delineated drainage boundary.

Given that the drainage area tributary to the study area consists of a significant amount of Agricultural land, which is not individually documented in the NSQD V4.02 tables, a separate source was referenced to obtain EMC data for this land use category. The document titled, "A User's Guide for the Structural BMP Prioritization and Analysis Tool (SBPAT V1.0) Technical Appendices," prepared by Geosyntec Consultants was consulted to reference the Agricultural Land Use EMCs. For reference purposes, SBPAT is a tool accepted by the State of California Los Angeles Regional Water Quality Control Board (LA RWQCB) to estimate BMP performance.

Table 7 presents a summary of median pollutant EMC values included in the continuous simulation water quality modeling.

Table 7: Median Pollutant Event Mean Concentration by Land Use

Land Use	Fecal Indicator Bacteria	Metals			Nutrients		Sediment
	FC	Cu	Pb	Zn	NO2 + NO3	TP	TSS
	MPN/100mL	ug/L	ug/L	ug/L	mg/L	mg/L	mg/L
Agricultural	60,300	100.1	30.2	274.8	43.37	3.34	999.2
Commercial	4200	13.3	11	119	0.7	0.19	52
Industrial	1980	14	9	140	0.6	0.22	74
Multi-Family Residential	9000	10.9	5	70	0.6	0.3	56
Open Space	2150	5.9	1	10	0.5	0.12	38
Single-Family Residential	9000	10.9	5	70	0.6	0.3	56
Transportation (Roads)	2000	24	31	130	1.2	0.25	74

Agricultural EMC data obtained from SBPAT Technical Appendices. Pollutant Removal Rates, paired influent, and effluent data from the 2016 version of the International Stormwater BMP Database 2016 (http://bmpdatabase.org/) was used to estimate the performance of the Newman Environmental Wetland System. Table 8 presents a summary of average influent concentrations entering the BMP and the estimated effluents leaving the forebay and the constructed wetland/micro pool and derived percent reductions for each pollutant type.

Table 8: Median Pollutant Inflow/Outflow Concentrations and Percent Reductions

Pollutant Category	Pollutant	Average Influent Concentration	Forebay		Constructed Wetland / Micro Pool[1]	
			Effluent	% Reduction	Effluent	% Reduction
Fecal Indicator Bacteria	FC	15,962 MPN/100mL	14,827 MPN/100mL	7%	6,704 MPN/100mL	58%
Metals	Cu	34.24 ug/L	21.3 ug/L	38%	15.3 ug/L	55%
	Pb	19.99 ug/L	19.3 ug/L	3%	5.7 ug/L	71%
	Zn	143 ug/L	84.5 ug/L	41%	45.9 ug/L	68%
Nutrients	NO2 + NO3	9.62 mg/L	4.2 mg/L	56%	2.4 mg/L	75%
	TP	0.89 mg/L	0.37 mg/L	59%	0.30 mg/L	67%
Sediment	TSS	258 mg/L	94 mg/L	64%	53.8 mg/L	79%

1. Same treatment efficiency was used for both the constructed wetland cell and the storage in micro pool between 74.5' to 78' as the same outlet works controls the drawdown time in both cells. Once the performance was estimated it was then subdivided based on the weightage of detention storage.

III MODELING RESULTS AND STORM WATER QUALITY BENEFITS

III.1 Pollutant Contributions

Table 9 presents the wet weather loads for the 85th percentile event and average annual loads. Table 10 presents urban wet weather loads for the 85th percentile event and average annual loads. Table 11 presents agricultural wet weather loads for the 85th percentile event and average annual loads. The breakdown between urban and agricultural loads were calculated using an approximate method utilizing land area, event mean concentrations and runoff factors.

Table 9: Wet Weather Loads

Pollutant Category	Pollutant	Long-term DMA: DMA North + DMA Central		Short-term DMA: DMA North + DMA Central + DMA South	
		85th	Avg. Annual	85th	Avg. Annual
Fecal Indicator Bacteria	FC (MPN)	1.1E+13	2.2E+14	1.5E+13	2.8E+14
Metals	Cu (Kg)	2.8	91	3.5	102
	Pb (Kg)	1.0	32	1.2	35
	Zn (Kg)	8.9	283	10.8	315
Nutrients	NO2 + NO3 (Kg)	1,083	36,028	1,357	40,675
	TP (Kg)	88	2,916	110	3,279
Sediment	TSS (Kg)	25,970	858,892	32,400	967,169

Table 10: Urban Wet Weather Loads

Pollutant Category	Pollutant	Long-term DMA: DMA North + DMA Central		Short-term DMA: DMA North + DMA Central + DMA South	
		85th	Avg. Annual	85th	Avg. Annual
Fecal Indicator Bacteria	FC (MPN)	3.5E+12	7.0E+13	4.0E+12	7.9E+13
Metals	Cu (Kg)	1.4	47	1.6	50
	Pb (Kg)	0.8	25	0.9	27
	Zn (Kg)	6.3	200	7.2	215
Nutrients	NO2 + NO3 (Kg)	119	3,969	130	4,157
	TP (Kg)	28	939	31	990
Sediment	TSS (Kg)	7,485	247,533	8,304	261,327

Table 11: Agricultural Wet Weather Loads

Pollutant Category	Pollutant	Long-term DMA: DMA North + DMA Central		Short-term DMA: DMA North + DMA Central + DMA South	
		85th	Avg. Annual	85th	Avg. Annual
Fecal Indicator Bacteria	FC (MPN)	7.5E+12	1.5E+14	1.1E+13	2.1E+14
Metals	Cu (Kg)	1.4	44	1.8	52
	Pb (Kg)	0.2	7	0.3	9
	Zn (Kg)	2.6	83	3.6	100
Nutrients	NO2 + NO3 (Kg)	964	32,059	1,227	36,518
	TP (Kg)	60	1,977	78	2,289
Sediment	TSS (Kg)	18,485	611,359	24,096	705,842

III.2 Pollutant Load Reduction Results

Pollutant time series were exported from the PCSWMM model results and analyzed in a spreadsheet. This allowed the wetlands influent/effluent pollutant quantities reported hourly by the model to be aggregated, in order to identify the pollutant reduction metrics. Table 12 presents a summary of wet weather pollutant load reduction for the 85th percentile and Table 13 presents a summary of wet weather pollutant load reductions based on continuous simulation (Water Year 1949 to 2013 – 65 Years). The wet weather load reductions are summarized for each system component and the combined system. The permanent micro pool captures and treats the dry weather and agricultural return flows through both sedimentation and biological uptake process.

Table 12: Pollutant Load Reduction – 85th Percentile Storm

Long-term DMA: DMA North + DMA Central							
Land Use	**Fecal Indicator Bacteria (MPN)**	**Metals (Kg)**			**Nutrients (Kg)**		**Sediment (kg)**
	FC	**Cu**	**Pb**	**Zn**	**NO2 + NO3**	**TP**	**TSS**
Sediment Forebay	1.27E+12	1.26	0.14	4.21	662	56.2	17,683
Constructed Wetlands	4.74E+12	0.67	0.47	2.41	235	16.3	4,830
Micro pool	1.91E+12	0.26	0.19	0.95	93	6.4	1,928
Combined System	**7.92E+12**	**2.20**	**0.80**	**7.57**	**991**	**79**	**24,441**
Percent Removals							
Sediment Forebay	12%	45%	14%	48%	61%	64%	68%
Constructed Wetlands	43%	24%	46%	27%	22%	18%	19%
Micro pool	17%	9%	18%	11%	9%	7%	7%
Combined System	**72%**	**78%**	**78%**	**86%**	**92%**	**90%**	**94%**
% Urban Contributions[1]	100%	100%	100%	100%	100%	100%	100%
% of Agricultural land use Contributions[2]	59%	56%	3%	51%	90%	85%	92%

Notes: 1. Based on these results, NEWS is anticipated to remove 100% of the wet weather pollutant contributions from the urban land uses associated with all storms up to and including the 85th percentile, 24-hour storm event
2. This row is based on load reductions achieved greater than the wet weather pollutant loads generated from urban land uses.

Short-term DMA: DMA North + DMA Central + DMA South							
Land Use	**Fecal Indicator Bacteria (MPN)**	**Metals (Kg)**			**Nutrients (Kg)**		**Sediment (kg)**
	FC	**Cu**	**Pb**	**Zn**	**NO2 + NO3**	**TP**	**TSS**
Sediment Forebay	1.68E+12	1.52	0.16	5.04	819	69.1	21,854
Constructed Wetlands	6.32E+12	0.85	0.58	2.98	300	20.7	6,141
Micro pool	2.56E+12	0.33	0.23	1.19	121	8.3	2,471
Combined System	**1.06E+13**	**2.70**	**0.97**	**9.21**	**1,239**	**98.1**	**30,466**
Percent Removals							
Sediment Forebay	11%	44%	12%	47%	60%	63%	67%
Constructed Wetlands	42%	24%	47%	28%	22%	19%	19%
Micro pool	17%	10%	19%	11%	9%	8%	8%
Combined System	**70%**	**78%**	**78%**	**86%**	**91%**	**90%**	**94%**
% Urban Contributions[1]	100%	100%	100%	100%	100%	100%	100%
% of Agricultural land use Contributions[2]	60%	59%	16%	56%	90%	85%	92%

Notes: 1. Based on these results, NEWS is anticipated to remove 100% of the wet weather pollutant contributions from the urban land uses associated with all storms up to and including the 85th percentile, 24-hour storm event
2. This row is based on load reductions achieved greater than the wet weather pollutant loads generated from urban land uses.

Table 13: Pollutant Load Reduction – Average Annual

Long-term DMA: DMA North + DMA Central							
Land Use	Fecal Indicator Bacteria (MPN)	Metals (Kg)			Nutrients (Kg)		Sediment (kg)
	FC	Cu	Pb	Zn	NO2 + NO3	TP	TSS
Sediment Forebay	2.68E+13	34	2	112	19,815	1,631	519,785
Constructed Wetlands	7.49E+13	22	14	77	8,003	547	163,429
Micro pool	3.13E+13	8	6	30	3,176	216	65,135
Combined System	**1.33E+14**	**64**	**22**	**219**	**30,364**	**2,394**	**748,349**
Percent Removals							
Sediment Forebay	12%	37%	7%	39%	53%	56%	61%
Constructed Wetlands	34%	24%	45%	27%	22%	19%	19%
Micro pool	14%	9%	18%	11%	9%	7%	8%
Combined System	**60%**	**70%**	**70%**	**77%**	**84%**	**82%**	**88%**
% Urban Contributions[1]	100%	100%	90%	100%	100%	100%	100%
% of Agricultural land use Contribution[2]	42%	39%	0%	23%	82%	74%	82%

1. Based on these results, Newman Environmental Wetland System is anticipated to remove 100% of the wet weather pollutants from the urban land uses (except for lead).
2. This row is based on load reductions achieved greater than the wet weather pollutant loads generated from urban land uses.

Short-term DMA: DMA North + DMA Central + DMA South							
Land Use	Fecal Indicator Bacteria (MPN)	Metals (Kg)			Nutrients (Kg)		Sediment (kg)
	FC	Cu	Pb	Zn	NO2 + NO3	TP	TSS
Sediment Forebay	3.33E+13	36	2	120	20,837	1,765	562,523
Constructed Wetlands	8.98E+13	24	15	82	8,623	588	175,633
Micro pool	3.76E+13	9	6	33	3,439	233	70,287
Combined System	**1.61E+14**	**69**	**24**	**234**	**32,899**	**2,586**	**808,443**
Percent Removals							
Sediment Forebay	12%	36%	7%	38%	51%	54%	58%
Constructed Wetlands	32%	23%	43%	26%	21%	18%	18%
Micro pool	13%	9%	17%	10%	8%	7%	7%
Combined System	**57%**	**68%**	**67%**	**74%**	**80%**	**79%**	**83%**
% Urban Contributions[1]	100%	100%	89%	100%	100%	100%	100%
% of Agricultural land use Contribution[2]	40%	37%	0%	19%	79%	70%	78%

1. Based on these results, Newman Environmental Wetland System is anticipated to remove 100% of the wet weather pollutants from the urban land uses (except for lead).
2. This row is based on load reductions achieved greater than the wet weather pollutant loads generated from urban land uses.

III.3 Stormwater Capture/Retention Results

The continuous simulation (Water Year (WY) 1949 to 2013 – 65 years) and the 85th percentile model incorporated evapotranspiration (for all three components) and native soil infiltration parameters (for constructed wetland cell) to quantify the amount of water that is retained through the implementation of the project. While the project design is not intended to function as an infiltration BMP since there is relatively shallow groundwater, there will be incidental infiltration that occurs as the underlying soil acts as a sponge. Table 14 summarizes the water balance results which was analyzed at the inflow and outflow points of the Newman Environmental Wetland System.

Table 14: Stormwater Capture/Retention Results

	Scenario 1: Newman + North Ag	Scenario 2: Newman + North Ag + South Ag
Wet Weather Volume from 85th Percentile	31.9 acre-feet	39.9 acre-feet
Percent of 85th Percentile treated by the BMP	100%	100%
Average Wet Weather Volume Per Year	585 acre-feet	699 acre-feet
Average Dry Weather Volume Per Year	652 acre-feet	652 acre-feet
Total Average Volume Per Year (Dry + Wet)	1,237 acre-feet	1,351 acre-feet
Dry and Wet Weather Volume treated by the BMP Per Year	1,156 acre-feet (93.4%)	1,216 acre-feet (90%)
Average Volume Captured and Filtered Per Year	1,087 acre-feet (87.9%)	1,147 acre-feet (84.9%)
Average Volume Reduction by Infiltration Per Year	45 acre-feet (3.6%)	46 acre-feet (3.4%)
Average Volume Reduction by Evaporation Per Year	24 acre-feet (1.9%)	23 acre-feet (1.7%)

III.4 Trash Generation and Reduction

Pursuant to the State Trash Amendment (as discussed in the City of Newman Stormwater Management Project - Task 3.3 Preliminary Design Concepts, prepared by Rick Engineering Company, and dated June 6, 2019), full-trash capture devices must be designed to capture particles that are 5-mm or greater for the 1-year, 1-hour storm event for Priority Land Use Areas (PLUs). To quantify the trash generation and reduction for the City of Newman, this analysis focused first on PLU areas. PLUs are defined as land uses that studies have shown to generate significant sources of trash and include: high density residential, industrial, commercial, mixed urban and public transportation stations. GIS Parcel data was utilized to determine the acreage of each PLU type within the City and was multiplied by a trash generation factor based on land use. Since the project is proposing the use of a certified full-trash capture device (as approved by the State Water Resources Control Board), or an alternative non-proprietary screen sized for the same 5 mm particle size and 1-year, 1-hour storm event, it is assumed that the reduction in volume of trash is equal to the amount of trash generated from the City. Table 15 provides a summary of the annual trash generation based on PLU type and annual load reduction for the City during the short- and long-term scenarios..

Table 15: Trash Generation and Load Reduction Summary

	Short Term Scenario (DMA North + DMA Central + DMA South)							
	High Density Residential	**Industrial**	**Commercial**	**Mixed Urban**	**Public Transportation Stations**	**Non-PLU Trash Generating Areas[3]**	**Subtotal for PLU Area Managed[2]**	
Area (acres)	107.2	132.7	78.4	0.0	0	536.6	**318.3**	
Trash Generation Rate (gal/ac/yr.)[1]	2.5	2.6	6.0	2.5	6.0	1.0	**Total Annual Trash Load Reduction from PLU Areas (gal/yr)**	**Total Annual Trash Load Reduction (Including PLU & Non-PLU Areas) (gal/yr)**
Annual Trash Generated (gal/yr.)	268.0	345.0	470.3	0.0	0.0	536.6	**1083.3**	**1619.9**

Notes: 1. Trash generation rates were obtained from a study performed for the County of San Diego titled "Technical Memorandum for Countywide Inlet Mapping, Collection, and Drainage Area Delineations", dated November 2, 2018.
2. PLU Acreage is based on existing land use and not zoned land use.
3. Non-PLU trash generating areas are comprised of single-family residential land uses and does not include agricultural or Open Space land use.

	Long Term Scenario (DMA North + DMA Central)							
	High Density Residential	**Industrial**	**Commercial**	**Mixed Urban**	**Public Transportation Stations**	**Non-PLU Trash Generating Areas[3]**	**Subtotal for PLU Area Managed[2]**	
Area (acres)	87.7	92.7	53.7	0.0	0	453.8	**234.0**	
Trash Generation Rate (gal/ac/yr.)[1]	2.5	2.6	6.0	2.5	6.0	1.0	**Total Annual Trash Load Reduction from PLU Areas (gal/yr)**	**Total Annual Trash Load Reduction (Including PLU & Non-PLU Areas) (gal/yr)**
Annual Trash Generated (gal/yr.)	219.2	241.0	322.0	0.0	0.0	453.8	**782.1**	**1235.9**

Notes: 1. Trash generation rates were obtained from a study performed for the County of San Diego titled "Technical Memorandum for Countywide Inlet Mapping, Collection, and Drainage Area Delineations", dated November 2, 2018.
2. PLU Acreage is based on existing land use and not zoned land use.
3. Non-PLU trash generating areas are comprised of single-family residential land uses and does not include agricultural or Open Space land use.

It should be noted that not all of the City's PLU Areas are routed through a full trash capture system during the long term scenario; however, the total trash captured (including trash generated from non-PLU areas) is greater than the trash generated from the City's PLU areas due to the amount of non-PLU areas that will be routed through the system. Based on the equivalent trash generation rate used for non-PLU areas in this study, it is anticipated that the project will continue to meet the requirements of the State Trash Amendment even during the long term scenario.

OPERATIONS AND MAINTENANCE DESIGN CONSIDERATIONS

The project will require long-term operations and Maintenance (O&M); therefore, the following components were designed to facilitate O&M:

- Access Roads were included to allow maintenance vehicles to drive the perimeter of each component (sediment forebay, wetland, and micro pool) and were designed to be a minimum of 15 feet based on anticipated maintenance vehicles (excavators, vactor, and utility trucks.) The access roads are set at an elevation approximately 2 feet above the design water surface elevation to provide conveyance and freeboard above the emergency spillways.
- Maintenance Ramps were included at each component (component (sediment forebay, wetland, and micro pool) to allow maintenance crews to drive down into the facilities if necessary (i.e., to remove sediment or debris). The ramps are a minimum of 15 feet wide
- A concrete pad was included within the sediment forebay to facilitate removal of accumulated sediment and debris and to minimize the potential for over-excavation during maintenance activities. The concrete pad only covers a portion of the sediment forebay from the inlet to the system to the first culvert to the wetland area.
- A permanent pump has included near the micro pool to allow draw-down of the micro pool's permanent pool to allow maintenance crews to access the bottom of the facility as needed (to remove accumulated debris/sediment or to inspect the facility)
- A maintenance storage and parking lot was included to allow crews to stage and store material and equipment as necessary.
- The full trash capture device will include manholes/hatches to allow access into the system to allow removal of accumulated trash and debris

PUBLIC SAFETY DESIGN CONSIDERATIONS

As a multi-purpose constructed storm water treatment wetland, the project will provide community benefit by providing access along the O&M road, which may serve a dual purpose as a public pathway. Public health and safety elements have been incorporated into the design including:

- Wooden Split rail fencing approximately 3 feet in height will run along the outer perimeter each of the system components (sediment forebay, wetland, and micro pool) to discourage people entering the facility
- Side slopes are all set at a maximum of 3:1 (H:V)
- Maintenance access ramps include bollards to prohibit unauthorized vehicular access
- An access gate is included to allow closure of the facility during larger maintenance operations or during times of non-operation
- A low-flow channel is provided to promote constant movement of water to deter stagnation and vector breeding. Other vector control components include facilitating access for surveillance, maintenance, and mosquito control activities, avoiding still, isolated, shallow areas, providing multiple flow paths among wetland components, and potentially the use of mosquito fish in the micro pool area (County of San Diego, 2010).
- Informational signage will be included as a learning opportunity for the community and to promote safety (i.e., do not enter, no swimming, no fishing, and/or no drinking signs)

LANDSCAPE DESIGN CONSIDERATIONS

The project includes vegetation and trees to support natural resource, community, and climate change objectives. Project landscape design considered:

- Appropriate vegetation for the local climate, native species that do not require extensive irrigation beyond establishment
- Appropriate vegetation for the different inundation zones within each system component (i.e., sediment forebay, wetland areas: low/high-marsh, micro pool, and bottoms versus side slopes)
- Plants and trees that support project objectives for community benefits (e.g., shading, respite areas)

IV DESIGN ASSUMPTIONS AND CONSIDERATIONS FOR FINAL DESIGN

Project design included the following simplifications and assumptions:

- Model simulations do not consider the flow attenuation effect of the detention basins located throughout the City of Newman & surrounding areas. It is assumed that the flowrate to the Miller ditch is controlled by the capacity of the existing stormwater pump station and that the upstream detention facilities are designed for this condition.

• Drainage areas contributing to Inyo Avenue Pump Station will have a restricted flow into Miller Ditch based on Pump Capacities per As-Built drawing (36,000 GPM ~ 80 cfs).

• Inyo Avenue Pump Station nuisance pump capacity of 400 gpm/0.9 cfs (per as-built drawing) incorporated as a dry-weather/agricultural return flow component into models.

• Conservatively, a 0.05 in/hr. infiltration rate was used for the constructed wetland cell.

• The benefits assigned to the permanent micro pool were for wet weather flows. The permanent pool removes pollutants from the dry weather and agricultural return flows through both sedimentation and biological uptake process, but this was not explicitly quantified as the pollutant loading rates for these flows are not readily available.

The construction documents prepared as part of this Prop. 1 solicitation were developed to a 60% design level; therefore, they will need to be further refined prior to construction of the project As the project continues forward, the following additional analysis/refinements will be necessary prior to final design and construction:

- Detailed hydraulic design that evaluates the floodplain limits and backwater conditions to support the design of different BMP elements (i.e., diversion design, outlet structures, protection against erosion for BMP components during the 100-year event, etc.);
- Groundwater level and infiltration rate measurements to refine the vertical elevations for different BMP components, quantify volume reduction benefits, and potentially a mounding analysis to evaluate the effect on the wetland design. It is understood that the City of Newman is currently contracting with a geotechnical engineer to install monitoring wells to collect groundwater information;
- Additional evaluation for thermal effects and water rights for any downstream sensitive habitat;
- Additional evaluation and design of the Full Trash Capture (FTC) device will be necessary to ensure final design of the FTC based on required treatment and peak discharge flow rates, maintenance access, and siting;
- Regulatory coordination with resource agencies (U.S. Army Corps of Engineers, California Department of Fish and Wildlife, Regional Water Quality Control Board, Etc.).

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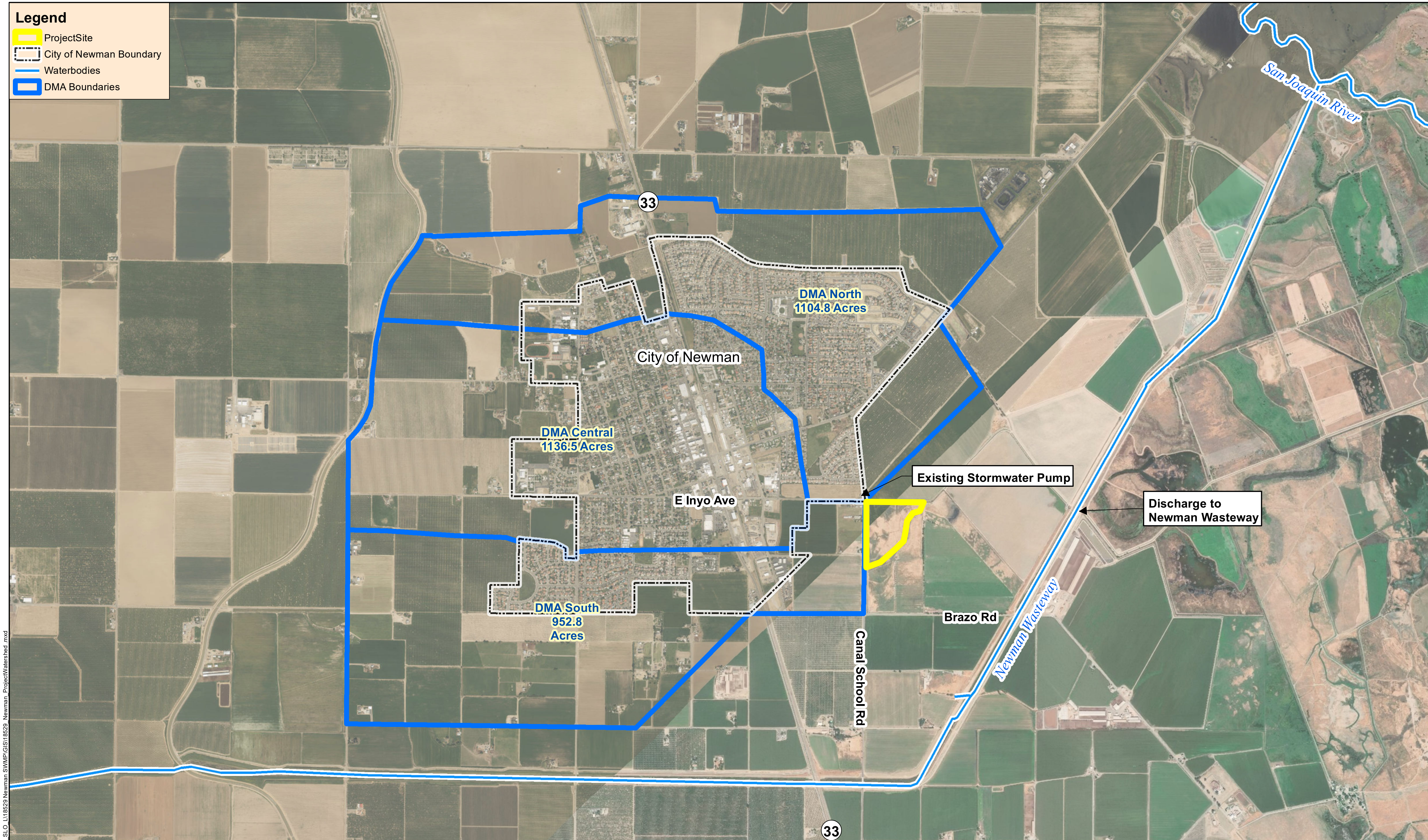
Attachment A Tributary Watersheds



RICK ENGINEERING COMPANY

0 0.25 0.5 1 Miles

North

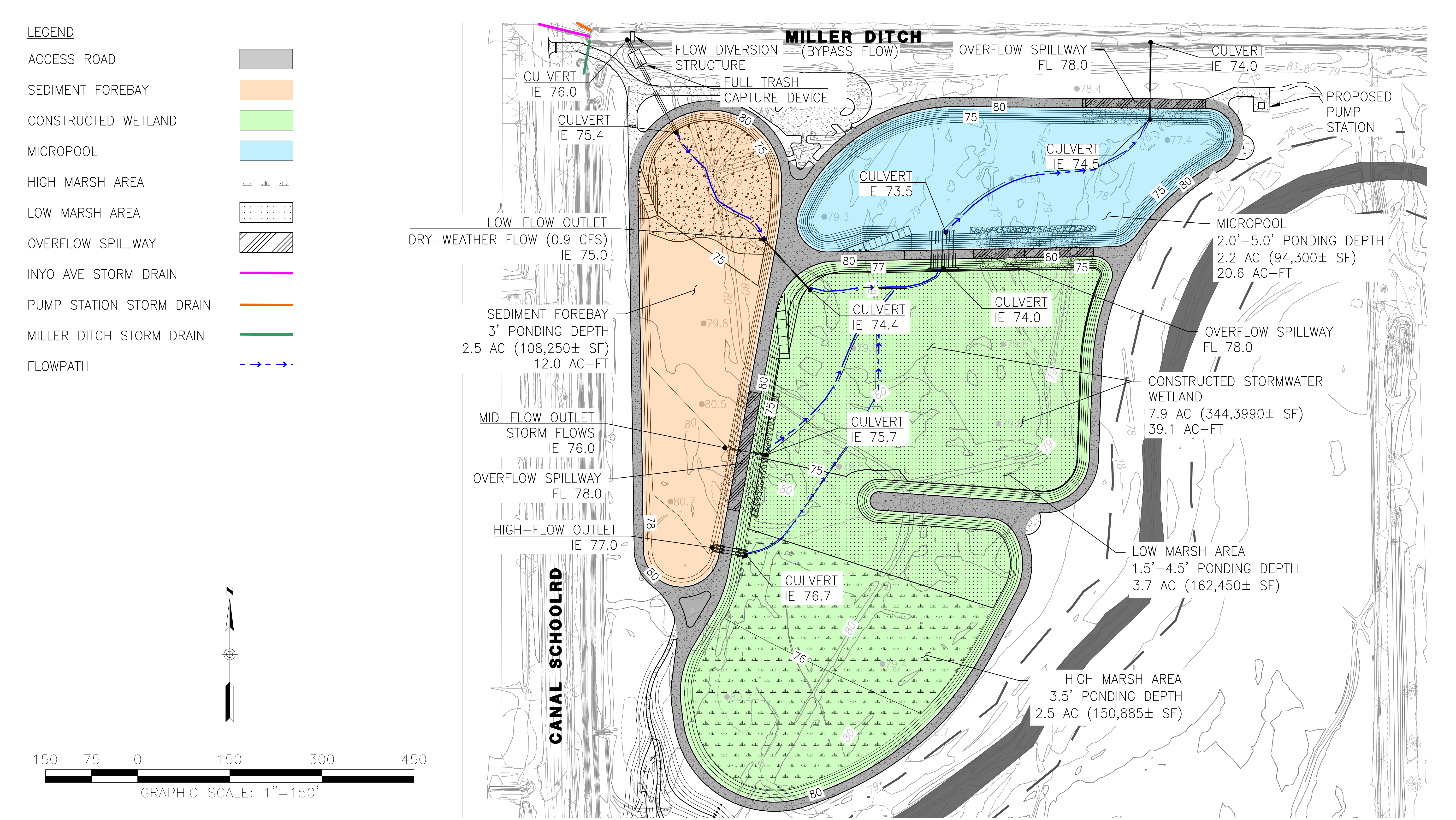
Date of Exhibit: 4/20/2020
DigitalGlobe Aerial Image: 04.2013

Project Site Tributary Watersheds

City of Newman Stormwater Management Project

J-18529

Attachment B Wetland Routing Schematic



PROJECT NO. 18579 3/16/2020

WETLAND SYSTEM ROUTING SCHEMATIC
NEWMAN ENVIRONMENTAL WETLAND SYSTEM

CITY OF NEWMAN, CA

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