

City of San Diego

CONTRACTOR'S NAME: California Skateparks
ADDRESS: 273 N Benson Ave, Upland, CA 91786
TELEPHONE NO.: (909) 949-1601 **FAX NO.:** (909) 981-9368
CITY CONTACT: Michelle Muñoz, Contract Specialist, Email: MichelleM@sandiego.gov
 Phone No. (619) 533-3482, Fax No. (619) 533-3633
 A.Corsi/RWBustamante/egz

BIDDING DOCUMENTS

**FOR**

Park De La Cruz Neighborhood Park Improvements – Phase I

BID NO.: _____ K-16-1457-DBB-3-A
 SAP NO. (WBS/IO/CC): _____ S-15003
 CLIENT DEPARTMENT: _____ 1714
 COUNCIL DISTRICT: _____ 9
 PROJECT TYPE: _____ GB

THIS CONTRACT WILL BE SUBJECT TO THE FOLLOWING:

- THE CITY'S SUBCONTRACTING PARTICIPATION REQUIREMENTS FOR SLBE PROGRAM.
- PREVAILING WAGE RATES: STATE FEDERAL
- APPRENTICESHIP
- THIS IS A HOUSING-RELATED PARKS FUNDED CONTRACT THROUGH THE DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT.

BID DUE DATE:**2:00 PM****JUNE 30, 2016****CITY OF SAN DIEGO****PUBLIC WORKS CONTRACTS**

**1010 SECOND AVENUE, 14th FLOOR, MS 614C
 SAN DIEGO, CA 92101**

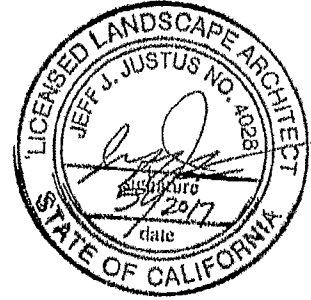
ENGINEER OF WORK

The engineering Specifications and Special Provisions contained herein have been prepared by or under the direction of the following Registered Landscape Architect:

Jeff Justus
1) Registered Landscape Architect

2/26/16
Date

Seal:



Samir M
2) For City Engineer

3/2/16
Date

Seal

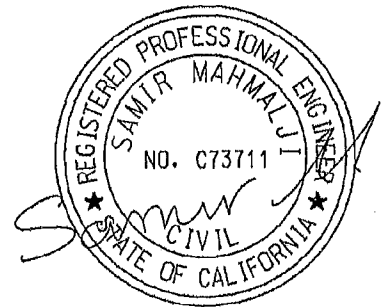


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NOTICE INVITING BIDS

1. **SUMMARY OF WORK:** This is the City of San Diego's (City) solicitation process to acquire Construction services for **Park de La Cruz Neighborhood Park Improvements – Phase I**. For additional information refer to Attachment A.
2. **FULL AND OPEN COMPETITION:** This contract is open to full competition and may be bid on by Contractors who are on the City's current Prequalified Contractors' List. For information regarding the Contractors Prequalified list visit the City's website: <http://www.sandiego.gov>.
3. **ESTIMATED CONSTRUCTION COST:** The City's estimated construction cost for this project is **\$2,750,000**.
4. **BID DUE DATE AND TIME ARE: JUNE 30, 2016, at 2:00 PM.**
5. **PREVAILING WAGE RATES APPLY TO THIS CONTRACT:** Refer to Attachment D.
6. **LICENSE REQUIREMENT:** The City has determined that the following licensing classification(s) are required for this contract: A
7. **SUBCONTRACTING PARTICIPATION PERCENTAGES:**
 - 7.1. The City has incorporated voluntary subcontractor participation percentage to enhance competition and maximize subcontracting opportunities as follows.
 - 7.2. The following voluntary subcontractor participation percentage for DBE, DVBE, WBE, MBE, SLBE, and ELBE certified Subcontractors shall apply to this contract:

Total voluntary subcontractor participation percentage for this project is 23.7%.

8. **PRE-BID MEETING:**
 - 8.1. Prospective Bidders are encouraged to attend the Pre-Bid Meeting. The purpose of the meeting is to discuss the scope of the Project, submittal requirements, the pre-qualification process and any Equal Opportunity Contracting Program requirements and reporting procedures. To request a sign language or oral interpreter for this visit, call the Public Works Contracts Division at (619) 533-3450 at least 5 Working Days prior to the meeting to ensure availability. The Pre-Bid meeting is scheduled as follows:

Date: JUNE 15, 2016
Time: 11:00 AM
Location: 1010 Second Avenue Suite 1400 (Large Conference Room)
San Diego, California, 92101

Attendance at the Pre-Bid Meeting will be evidenced by the Bidder's representative's signature on the attendance roster. It is the responsibility of the Bidder's representative to complete and sign the attendance roster.

9. AWARD PROCESS:

- 9.1. The Award of this contract is contingent upon the Contractor's compliance with all conditions of Award as stated within these documents and within the Notice of Intent to Award.
- 9.2. Upon acceptance of a Bid, the City will prepare contract documents for execution within approximately 21 days of the date of the Bid opening. The City will then award the Contract within approximately 14 days of receipt of properly signed Contract, bonds, and insurance documents.
- 9.3. This contract will be deemed executed and effective only upon the signing of the Contract by the Mayor or his designee and approval as to form the City Attorney's Office.
- 9.4. The low Bid will be determined by Base Bid alone.
- 9.5. Once the low bid has been determined, the City may, at its sole discretion, award the contract for the Base bid alone.

10. SUBMISSION OF QUESTIONS:

- 10.1. The Director (or designee), of the Public Works Department is the officer responsible for opening, examining, and evaluating the competitive Bids submitted to the City for the acquisition, construction and completion of any public improvement except when otherwise set forth in these documents. All questions related to this solicitation shall be submitted to:

Public Works Contracts
1010 Second Avenue, 14th Floor
San Diego, California, 92101
Attention: Michelle Muñoz

OR:

MichelleM@sandiego.gov

- 10.2. Questions received less than 14 days prior to the date for opening of Bids may not be considered.
- 10.3. Questions or clarifications deemed by the City to be material shall be answered via issuance of an addendum and posted to the City's online bidding service.
- 10.4. Only questions answered by formal written addenda shall be binding. Oral and other interpretations or clarifications shall be without legal effect. It is the Bidder's responsibility to be informed of any addenda that have been issued and to include all such information in its Bid.

11. CONTRACTOR EXPERIENCE: To be considered a qualified and responsible Bidder, the CONTRACTOR shall provide documentation establishing that they and/or their subcontractor has satisfied the experience requirements listed below:

- 11.1.** Shall have completed at least one (1) custom poured in place concrete skate park facility with a minimum size of 15,000 square feet within the last five (5) years. The Contractor and/or their subcontractor shall have performed all concrete & metal work for the project listed with the scope inclusion of one (1) bowl of 9'-0" minimum depth, including concrete and metal coping & tile. The shotcrete nozzlemen performing the shotcrete work shall have been Certified in accordance with ACI 506.3R. Referenced Skate Parks shall be open and in good operating condition for at least one (1) year. Contractor may provide more than one project to demonstrate required experience.
- 11.2.** Reference projects shall demonstrate experience in shaping of earthwork to specified radius'; cast in place concave and convex shaped concrete elements containing compound radius curves; application of vertical and horizontal shotcrete work including horizontal and vertical radius transitions that include compound radius curves and blends, formed concrete, grinding rails, and associated concrete reinforcement; installation of steel coping edges, smooth flowing seamless transition areas, and smooth troweled concrete finish work; layout, fabrication, and construction of the steel coping; and installation of concrete flatwork between bowled areas.
- 11.3.** Failure to demonstrate the required qualifications may deem the bid non-responsive and ineligible for further consideration.
- 11.4.** The Contractor Experience Reference Form located in the section of the solicitation entitled: "ELECTRONICALLY SUBMITTED FORMS"; must be completed and submitted at time of bid. Failure to submit the completed form may disqualify the bid as non-responsive.

INSTRUCTIONS TO BIDDERS

1. PREQUALIFICATION OF CONTRACTORS:

- 1.1. Contractors submitting a Bid must be pre-qualified for the total amount proposed, including all alternate items, prior to the date of submittal. Bids from contractors who have not been pre-qualified as applicable and Bids that exceed the maximum dollar amount at which contractors are pre-qualified may be deemed **non-responsive** and ineligible for award. Complete information and links to the on-line prequalification application are available at:

<http://www.sandiego.gov/cip/bidopps/prequalification.shtml>

- 1.2. The completed application must be submitted online no later than 2 weeks prior to the bid opening. For additional information or the answer to questions about the prequalification program, contact David Stucky at 619-533-3474 or dstucky@sandiego.gov.
- 1.3. Due to the City's fiduciary requirement to safeguard vendor data, City staff will not be able to provide information regarding contractors' prequalification status over the telephone. Contractors may access real-time information about their prequalification status via their vendor profile on [PlanetBids™](#).

2. ELECTRONIC FORMAT RECEIPT AND OPENING OF BIDS: Bids will be received in electronic format (eBids) EXCLUSIVELY at the City of San Diego's electronic bidding (eBidding) site, at: <http://www.sandiego.gov/cip/bidopps/index.shtml> and are due by the date, and time shown on the cover of this solicitation.

- 2.1. BIDDERS MUST BE PRE-REGISTERED with the City's bidding system and possess a system-assigned Digital ID in order to submit and electronic bid.
- 2.2. The City's bidding system will automatically track information submitted to the site including IP addresses, browsers being used and the URLs from which information was submitted. In addition, the City's bidding system will keep a history of every login instance including the time of login, and other information about the user's computer configuration such as the operating system, browser type, version, and more. Because of these security features, Contractors who disable their browsers' cookies will not be able to log in and use the City's bidding system.
- 2.3. The City's electronic bidding system is responsible for bid tabulations. Upon the bidder's or proposer's entry of their bid, the system will ensure that all required fields are entered. **The system will not accept a bid for which any required information is missing.** This includes all necessary pricing, subcontractor listing(s) and any other essential documentation and supporting materials and forms requested or contained in these solicitation documents.
- 2.4. BIDS REMAIN SEALED UNTIL BID DEADLINE. eBids are transmitted into the City's bidding system via hypertext transfer protocol secure (https) mechanism using SSL 128-256 bit security certificates issued from Verisign/Thawte which encrypts data being transferred from client to server. Bids submitted prior to the "Bid Due Date and Time" are not available for review by anyone other than the submitter which has until the "Bid Due Date and Time" to change, rescind or retrieve its proposal should it

desire to do so.

- 2.5. **BIDS MUST BE SUBMITTED BY BID DUE DATE AND TIME.** Once the bid deadline is reached, no further submissions are accepted into the system. Once the Bid Due Date and Time has lapsed, bidders, proposers, the general public, and City staff are able to immediately see the results on line. City staff may then begin reviewing the submissions for responsiveness, EOCP compliance and other issues. The City may require any Bidder to furnish statement of experience, financial responsibility, technical ability, equipment, and references.
- 2.6. **RECAPITULATION OF THE WORK.** Bids shall not contain any recapitulation of the Work. Conditional Bids may be rejected as being non-responsive. Alternative proposals will not be considered unless called for.
- 2.7. **BIDS MAY BE WITHDRAWN** by the Bidder only up to the bid due date and time.
 - 2.7.1. **Important Note:** Submission of the electronic bid into the system may not be instantaneous. Due to the speed and capabilities of the user's internet service provider (ISP), bandwidth, computer hardware and other variables, it may take time for the bidder's submission to upload and be received by the City's eBidding system. It is the bidder's sole responsibility to ensure their bids are received on time by the City's eBidding system. The City of San Diego is not responsible for bids that do not arrive by the required date and time.
- 2.8. **ACCESSIBILITY AND AMERICANS WITH DISABILITIES ACT (ADA) COMPLIANCE.**

To request a copy of this solicitation in an alternative format, contact the Public Works Contract Specialist listed in the cover of this solicitation at least five (5) working days prior to the Bid/Proposal due date to ensure availability.

3. ELECTRONIC BID SUBMISSIONS CARRY FULL FORCE AND EFFECT

- 3.1. The bidder, by submitting its electronic bid, acknowledges that doing so carries the same force and full legal effect as a paper submission with a longhand (wet) signature.
- 3.2. By submitting an electronic bid, the bidder certifies that the bidder has thoroughly examined and understands the entire Contract Documents (which consist of the plans and specifications, drawings, forms, affidavits and the solicitation documents), and that by submitting the eBid as its bid proposal, the bidder acknowledges, agrees to and is bound by the entire Contract Documents, including any addenda issued thereto, and incorporated by reference in the Contract Documents.
- 3.3. The Bidder, by submitting its electronic bid, agrees to and certifies under penalty of perjury under the laws of the State of California, that the certification, forms and affidavits submitted as part of this bid are true and correct.
- 3.4. The Bidder agrees to the construction of the project as described in Attachment "A- Scope of Work" for the City of San Diego, in accordance with the requirements set forth herein for the electronically submitted prices. The Bidder guarantees the Contract Price for a period of 120 days (90 days for federally funded contracts and contracts valued at \$500,000 or less) from the date of Bid opening. The duration of the Contract Price guarantee shall be extended by the number of days required for the City to obtain all items necessary to fulfill all conditions precedent.

4. **BIDS ARE PUBLIC RECORDS:** Upon receipt by the City, Bids shall become public records subject to public disclosure. It is the responsibility of the respondent to clearly identify any confidential, proprietary, trade secret or otherwise legally privileged information contained within the Bid. General references to sections of the California Public Records Act (PRA) will not suffice. If the Contractor does not provide applicable case law that clearly establishes that the requested information is exempt from the disclosure requirements of the PRA, the City shall be free to release the information when required in accordance with the PRA, pursuant to any other applicable law, or by order of any court or government agency, and the Contractor will hold the City harmless for release of this information.
5. **CONTRACTOR REGISTRATION AND ELECTRONIC REPORTING SYSTEM:**
- 5.1. **Prior** to the Award of the Contract or Task Order, you and your Subcontractors and Suppliers must register with the City's web-based vendor registration and bid management system. For additional information go to:

<http://www.sandiego.gov/purchasing/bids-contracts/vendorreg.shtml>.
- 5.2. The City may not award the contract until registration of all subcontractors and suppliers is complete. In the event this requirement is not met within the time frame specified in the Notice of Intent to Award letter, the City reserves the right to rescind the Notice of Award / Intent to Award and to make the award to the next responsive and responsible bidder / proposer.
6. **JOINT VENTURE CONTRACTORS:** Provide a copy of the Joint Venture agreement and the Joint Venture license to the City within 10 Working Days after receiving the Contract forms. See 2-1.1.2, "Joint Venture Contractors" in The WHITEBOOK for details.
7. **PREVAILING WAGE RATES WILL APPLY:** Refer to Attachment D.
8. **SUBCONTRACTING PARTICIPATION PERCENTAGES:** Subcontracting participation percentages apply to this contract. Refer to Attachment E.
9. **INSURANCE REQUIREMENTS:**
- 9.1. All certificates of insurance and endorsements required by the contract are to be provided upon issuance of the City's Notice of Intent to Award letter.
- 9.2. Refer to sections 7-3, "LIABILITY INSURANCE", and 7-4, "WORKERS' COMPENSATION INSURANCE" of the Supplementary Special Provisions (SSP) for the insurance requirements which must be met.
10. **REFERENCE STANDARDS:** Except as otherwise noted or specified, the Work shall be completed in accordance with the following standards:

Title	Edition	Document Number
Standard Specifications for Public Works Construction ("The GREENBOOK")	2012	PITS070112-01

Title	Edition	Document Number
City of San Diego Standard Specifications for Public Works Construction ("The WHITEBOOK")*	2012	PITTS070112-02
City of San Diego Standard Drawings*	2012	PITTS070112-03
Caltrans Standard Specifications	2010	PITTS070112-04
Caltrans Standard Plans	2010	PITTS070112-05
California MUTCD	2012	PITTS070112-06
City Standard Drawings - Updates Approved For Use (when specified)*	Varies	Varies
Standard Federal Equal Employment Opportunity Construction Contract Specifications and the Equal Opportunity	1984	769023
NOTE: *Available online under Engineering Documents and References at: http://www.sandiego.gov/publicworks/edocref/index.shtml		

11. **CITY'S RESPONSES AND ADDENDA:** The City, at its discretion, may respond to any or all questions submitted in writing via the City's eBidding web site in the **form of an addendum**. No other responses to questions, oral or written shall be of any force or effect with respect to this solicitation. The changes to the Contract Documents through addendum are made effective as though originally issued with the Bid. The Bidders shall acknowledge the receipt of Addenda at the time of bid submission.
12. **CITY'S RIGHTS RESERVED:** The City reserves the right to cancel the Notice Inviting Bids at any time, and further reserves the right to reject submitted Bids, without giving any reason for such action, at its sole discretion and without liability. Costs incurred by the Bidder(s) as a result of preparing Bids under the Notice Inviting Bids shall be the sole responsibility of each bidder. The Notice Inviting Bids creates or imposes no obligation upon the City to enter a contract.
13. **CONTRACT PRICING:** This solicitation is for a Lump Sum contract with Unit Price provisions as set forth herein. The Bidder agrees to perform construction services for the City of San Diego in accordance with these contract documents for the prices listed below. The Bidder further agrees to guarantee the Contract Price for a period of 120 days from the date of Bid opening. The duration of the Contract Price guarantee may be extended, by mutual consent of the parties, by the number of days required for the City to obtain all items necessary to fulfill all contractual conditions.
14. **SUBCONTRACTOR INFORMATION:**
 - 14.1. **LISTING OF SUBCONTRACTORS.** In accordance with the requirements provided in the "Subletting and Subcontracting Fair Practices Act" of the California Public Contract Code, the Bidder shall provide the **NAME** and **ADDRESS** of each Subcontractor who will perform work, labor, render services or who specially fabricates and installs a portion [type] of the work or improvement, in an amount in excess of 0.5% of the Contractor's total Bid. The Bidder shall also state within the description, whether the subcontractor is a **CONSTRUCTOR**, **CONSULTANT** or **SUPPLIER**. The Bidder shall further state within the description, the **PORTION** of the work which will be performed by each subcontractor under this Contract. The

Contractor shall list only one Subcontractor for each portion of the Work. The **DOLLAR VALUE** of the total Bid to be performed shall be stated for all subcontractors listed. Failure to comply with this requirement may result in the Bid being rejected as **non-responsive** and ineligible for award. The Bidder's attention is directed to the Special Provisions - General; Paragraph 2-3 Subcontracts, which stipulates the percent of the Work to be performed with the Bidders' own forces. The Bidder shall list all SLBE, ELBE, DBE, DVBE, MBE, WBE, OBE, SDB, WoSB, HUBZone, and SDVOSB Subcontractors for which Bidders are seeking recognition towards achieving any mandatory, voluntary (or both) subcontracting participation goals.

- 14.2. **LISTING OF SUPPLIERS.** Any Bidder seeking the recognition of Suppliers of equipment, materials, or supplies obtained from third party Suppliers towards achieving any mandatory or voluntary (or both) subcontracting participation goals shall provide, at a minimum, the **NAME, LOCATION (CITY)** and the **DOLLAR VALUE** of each supplier. The Bidder will be credited up to 60% of the amount to be paid to the Suppliers for materials and supplies unless vendor manufactures or substantially alters materials and supplies, in which case, 100% will be credited. The Bidder is to indicate within the description whether the listed firm is a supplier or manufacturer. If no indication is provided, the listed firm will be credited at 60% of the listed dollar value for purposes of calculating the Subcontractor Participation Percentage.
- 14.3. **LISTING OF SUBCONTRACTORS OR SUPPLIERS FOR ALTERNATES.** For subcontractors or suppliers to be used on additive or deductive alternate items, in addition to the above requirements, bidder shall further note "ALTERNATE" and alternate item number within the description.
15. **SUBMITTAL OF "OR EQUAL" ITEMS:** See Section 4-1.6, "Trade Names or Equals" in The WHITEBOOK and as amended in the SSP.
16. **AWARD PROCESS:**
 - 16.1. The Award of this contract is contingent upon the Contractor's compliance with all conditions precedent to Award.
 - 16.2. Upon acceptance of a Bid, the City will prepare contract documents for execution within approximately 21 days of the date of the Bid opening and award the Contract approximately within 7 days of receipt of properly executed Contract, bonds, and insurance documents.
 - 16.3. This contract will be deemed executed and effective only upon the signing of the Contract by the Mayor or his designee and approval as to form the City Attorney's Office.
17. **SUBCONTRACT LIMITATIONS:** The Bidder's attention is directed to Standard Specifications for Public Works Construction, Section 2-3, "SUBCONTRACTS" in The GREENBOOK and as amended in the SSP which requires the Contractor to self-perform not less than the specified amount. Failure to comply with this requirement shall render the bid **non-responsive** and ineligible for award.
18. **AVAILABILITY OF PLANS AND SPECIFICATIONS:** Contract Documents may be obtained by visiting the City's website: <http://www.sandiego.gov/cip/>. Plans and Specifications for this contract are also available for review in the office of the City Clerk or Public Works Contracts.

19. **ONLY ONE BID PER CONTRACTOR SHALL BE ACCEPTED:** No person, firm, or corporation shall be allowed to make, file, or be interested in more than one (1) Bid for the same work unless alternate Bids are called for. A person, firm or corporation who has submitted a sub- proposal to a Bidder, or who has quoted prices on materials to a Bidder, is not hereby disqualified from submitting a sub-proposal or quoting prices to other Bidders or from submitting a Bid in its own behalf. Any Bidder who submits more than one bid will result in the rejection of all bids submitted.

20. **SAN DIEGO BUSINESS TAX CERTIFICATE:** The Contractor and Subcontractors, not already having a City of San Diego Business Tax Certificate for the work contemplated shall secure the appropriate certificate from the City Treasurer, Civic Center Plaza, first floor and submit to the Contract Specialist upon request or as specified in the Contract Documents. Tax Identification numbers for both the Bidder and the listed Subcontractors must be submitted on the City provided forms within these documents.

21. **BIDDER'S GUARANTEE OF GOOD FAITH (BID SECURITY):**
 - 21.1. For bids \$250,000 and above, bidders shall submit Bid Security at bid time. Bid Security shall be in one of the following forms: a cashier's check, or a properly certified check upon some responsible bank; or an approved corporate surety bond payable to the City of San Diego for an amount of not less than 10% of the total bid amount.
 - 21.2. This check or bond, and the monies represented thereby, will be held by the City as a guarantee that the Bidder, if awarded the contract, will in good faith enter into the contract and furnish the required final performance and payment bonds.
 - 21.3. The Bidder agrees that in the event of the Bidder's failure to execute this contract and provide the required final bonds, the money represented by the cashier's or certified check will remain the property of the City; and the Surety agrees that it will pay to the City the damages, not exceeding the sum of 10% of the amount of the Bid, that the City may suffer as a result of such failure.
 - 21.4. At the time of bid submission, bidders must upload and submit an electronic PDF copy of the aforementioned bid security. Whether in the form of a cashier's check, a properly certified check or an approved corporate surety bond payable to the City of San Diego, the bid security must be uploaded to the City's eBidding system. Within twenty-four (24) hours after the bid due date and time, the first five (5) apparent low bidders must provide the City with the original bid security.
 - 21.5. Failure to submit the electronic version of the bid security at the time of bid submission AND failure to provide the original within twenty-four (24) hours may cause the bid to be rejected and deemed **non-responsive**.

22. **AWARD OF CONTRACT OR REJECTION OF BIDS:**
 - 22.1. This contract may be awarded to the lowest responsible and reliable Bidder.
 - 22.2. Bidders shall complete ALL eBid forms as required by this solicitation. Incomplete eBids will not be accepted.

- 22.3. The City reserves the right to reject any or all Bids, to waive any informality or technicality in Bids received, and to waive any requirements of these specifications as to bidding procedure.
 - 22.4. Bidders will not be released on account of their errors of judgment. Bidders may be released only upon receipt by the City within 3 Working Days of the bid opening, written notice from the Bidder which shows proof of honest, credible, clerical error of a material nature, free from fraud or fraudulent intent; and of evidence that reasonable care was observed in the preparation of the Bid.
 - 22.5. A bidder who is not selected for contract award may protest the award of a contract to another bidder by submitting a written protest in accordance with the San Diego Municipal Code.
 - 22.6. The City of San Diego will not discriminate in the award of contracts with regard to race, religion creed, color, national origin, ancestry, physical handicap, marital status, sex or age.
 - 22.7. Each Bid package properly signed as required by these specifications shall constitute a firm offer which may be accepted by the City within the time specified herein.
 - 22.8. The City reserves the right to evaluate all Bids and determine the lowest Bidder on the basis of the base bid and any proposed alternates or options as detailed herein.
- 23. BID RESULTS:**
- 23.1. The availability of the bids on the City's eBidding system shall constitute the public announcement of the apparent low bidder. In the event that the apparent low bidder is subsequently deemed non-responsive or non-responsible, a notation of such will be made on the eBidding system. The new ranking and apparent low bidder will be adjusted accordingly.
 - 23.2. To obtain the bid results, view the results on the City's web site, or request the results by U.S. mail and provide a self-addressed, stamped envelope. If requesting by mail, be sure to reference the bid name and number. The bid tabulations will be mailed to you upon their completion. The results will not be given over the telephone.
- 24. THE CONTRACT:**
- 24.1. The Bidder to whom award is made shall execute a written contract with the City of San Diego and furnish good and approved bonds and insurance certificates specified by the City within 14 days after receipt by Bidder of a form of contract for execution unless an extension of time is granted to the Bidder in writing.
 - 24.2. If the Bidder takes longer than 14 days to fulfill these requirements, then the additional time taken shall be added to the Bid guarantee. The Contract shall be made in the form adopted by the City, which includes the provision that no claim or suit whatsoever shall be made or brought by Contractor against any officer, agent, or employee of the City for or on account of anything done or omitted to be done in connection with this contract, nor shall any such officer, agent, or employee be liable hereunder.

- 24.3. If the Bidder to whom the award is made fails to enter into the contract as herein provided, the award may be annulled and the Bidder's Guarantee of Good Faith will be subject to forfeiture. An award may be made to the next lowest responsible and reliable Bidder who shall fulfill every stipulation embraced herein as if it were the party to whom the first award was made.
- 24.4. Pursuant to the San Diego City Charter section 94, the City may only award a public works contract to the lowest responsible and reliable Bidder. The City will require the Apparent Low Bidder to (i) submit information to determine the Bidder's responsibility and reliability, (ii) execute the Contract in form provided by the City, and (iii) furnish good and approved bonds and insurance certificates specified by the City within 14 Days, unless otherwise approved by the City, in writing after the Bidder receives notification from the City, designating the Bidder as the Apparent Low Bidder and formally requesting the above mentioned items.
- 24.5. The award of the Contract is contingent upon the satisfactory completion of the above mentioned items and becomes effective upon the signing of the Contract by the Mayor or designee and approval as to form the City Attorney's Office. If the Apparent Low Bidder does not execute the Contract or submit required documents and information, the City may award the Contract to the next lowest responsible and reliable Bidder who shall fulfill every condition precedent to award. A corporation designated as the Apparent Low Bidder shall furnish evidence of its corporate existence and evidence that the officer signing the Contract and bond for the corporation is duly authorized to do so.
25. **EXAMINATION OF PLANS, SPECIFICATIONS, AND SITE OF WORK:** The Bidder shall examine carefully the Project Site, the Plans and Specifications, other materials as described in the Special Provisions, Section 2-7, and the proposal forms (e.g., Bidding Documents). The submission of a Bid shall be conclusive evidence that the Bidder has investigated and is satisfied as to the conditions to be encountered, as to the character, quality, and scope of Work, the quantities of materials to be furnished, and as to the requirements of the Bidding Documents Proposal, Plans, and Specifications.
26. **CITY STANDARD PROVISIONS:** This contract is subject to the following standard provisions. See The WHITEBOOK for details.
- 26.1. The City of San Diego Resolution No. R-277952 adopted on May 20, 1991 for a Drug- Free Workplace.
- 26.2. The City of San Diego Resolution No. R-282153 adopted on June 14, 1993 related to the Americans with Disabilities Act.
- 26.3. The City of San Diego Municipal Code §22.3004 for Pledge of Compliance.
- 26.4. The City of San Diego's Labor Compliance Program and the State of California Labor Code §§1771.5(b) and 1776.
- 26.5. Sections 1777.5, 1777.6, and 1777.7 of the State of California Labor Code concerning the employment of apprentices by contractors and subcontractors performing public works contracts.
- 26.6. The City's Equal Benefits Ordinance (EBO), Chapter 2, Article 2, Division 43 of The San Diego Municipal Code (SDMC).
- 26.7. The City's Information Security Policy (ISP) as defined in the City's Administrative Regulation 90.63.

27. PRE-AWARD ACTIVITIES:

- 27.1. The contractor selected by the City to execute a contract for this Work shall submit the required documentation as specified in the herein and in the Notice of Award. Failure to provide the information as specified may result in the Bid being rejected as **non-responsive**.
- 27.2. The decision that bid is non-responsive for failure to provide the information required within the time specified shall be at the sole discretion of the City.

PERFORMANCE BOND, LABOR AND MATERIALMEN'S BOND

BOND NO. 0689331

FAITHFUL PERFORMANCE BOND AND LABOR AND MATERIALMEN'S BOND:

California Skateparks _____, a corporation, as principal, and **INTERNATIONAL FIDELITY INSURANCE COMPANY** _____, a corporation authorized to do business in the State of California, as Surety, hereby obligate themselves, their successors and assigns, jointly and severally, to The City of San Diego a municipal corporation in the sum of Three Million Four Hundred Nine Thousand Nine Hundred Forty Dollars and 00/100 (\$3,409,940.00) for the faithful performance of the annexed contract, and in the sum of Three Million Four Hundred Nine Thousand Nine Hundred Forty Dollars and 00/100 (\$3,409,940.00) for the benefit of laborers and materialmen designated below.

Conditions:

If the Principal shall faithfully perform the annexed contract with the City of San Diego, California, then the obligation herein with respect to a faithful performance shall be void; otherwise it shall remain in full force.

If the Principal shall promptly pay all persons, firms and corporations furnishing materials for or performing labor in the execution of this contract, and shall pay all amounts due under the California Unemployment Insurance Act then the obligation herein with respect to laborers and materialmen shall be void; otherwise it shall remain in full force.

The obligation herein with respect to laborers and materialmen shall inure to the benefit of all persons, firms and corporations entitled to file claims under the provisions of Article 2. Claimants, (iii) public works of improvement commencing with Civil Code Section 9100 of the Civil Code of the State of California.

Changes in the terms of the annexed contract or specifications accompanying same or referred to therein shall not affect the Surety's obligation on this bond, and the Surety hereby waives notice of same.

PERFORMANCE BOND, LABOR AND MATERIALMEN'S BOND (continued)

The Surety shall pay reasonable attorney's fees should suit be brought to enforce the provisions of this bond.

Dated July 19, 2016

Approved as to Form

CALIFORNIA SKATEPARKS

Principal

By  Joseph M. Ciaglia, Jr. / President

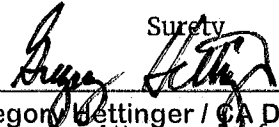
Printed Name of Person Signing for Principal

Jan I. Goldsmith, City Attorney

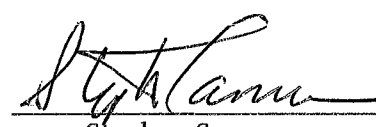
By 

Deputy City Attorney

INTERNATIONAL FIDELITY INSURANCE COMPANY

By  Gregory Wettinger / CA DOI License #0B52655
Attorney-in-fact

Approved:

By: 
Stephen Samara
Principal Contract Specialist
Public Works Department

5261 S Quebec Street #100

Local Address of Surety

Greenwood Village, CO 80111

Local Address (City, State) of Surety

303.705.9887

Local Telephone No. of Surety

Premium \$ 33,558.00

Bond No. 0689331

ACKNOWLEDGMENT

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

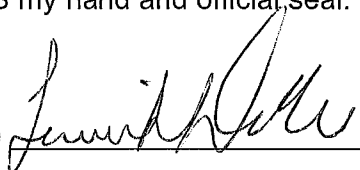
State of California ^{Colorado}
County of Arapahoe)

On July 19, 2016 before me, Tanisha Darden
(insert name and title of the officer)

personally appeared Gregory Hettinger,
who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California ^{Colorado} that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

Signature 

(Seal)

**TANISHA DARDEN
NOTARY PUBLIC
STATE OF COLORADO
NOTARY ID 20144015023
MY COMMISSION EXPIRES APRIL 7, 2018**

POWER OF ATTORNEY

INTERNATIONAL FIDELITY INSURANCE COMPANY ALLEGHENY CASUALTY COMPANY

ONE NEWARK CENTER, 20TH FLOOR NEWARK, NEW JERSEY 07102-5207
BOND NO. 0689331

KNOW ALL MEN BY THESE PRESENTS: That INTERNATIONAL FIDELITY INSURANCE COMPANY, a corporation organized and existing under the laws of the State of New Jersey, and ALLEGHENY CASUALTY COMPANY, a corporation organized and existing under the laws of the State of New Jersey, having their principal office in the City of Newark, New Jersey, do hereby constitute and appoint

GREGORY HETTINGER

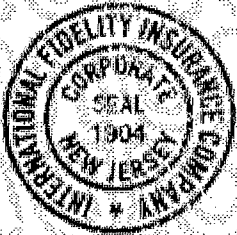
Greenwood Village, CO

their true and lawful attorney(s) in fact to execute, seal and deliver for and on its behalf as surety, any and all bonds and undertakings, contracts of indemnity and other writings obligatory in the nature thereof, which are or may be allowed, required or permitted by law, statute, rule, regulation, contract or otherwise, and the execution of such instrument(s) in pursuance of these presents, shall be as binding upon the said INTERNATIONAL FIDELITY INSURANCE COMPANY and ALLEGHENY CASUALTY COMPANY, as fully and amply, to all intents and purposes, as if the same had been duly executed and acknowledged by their regularly elected officers at their principal offices.

This Power of Attorney is executed and may be revoked, pursuant to and by authority of the By-Laws of INTERNATIONAL FIDELITY INSURANCE COMPANY and ALLEGHENY CASUALTY COMPANY and is granted under and by authority of the following resolution adopted by the Board of Directors of INTERNATIONAL FIDELITY INSURANCE COMPANY at a meeting duly held on the 20th day of July, 2010 and by the Board of Directors of ALLEGHENY CASUALTY COMPANY at a meeting duly held on the 15th day of August, 2000:

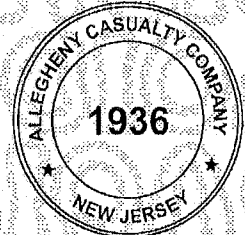
"RESOLVED, that: (1) the President, Vice President, Chief Executive Officer or Secretary of the Corporation shall have the power to appoint, and to revoke the appointments of, Attorneys-in-Fact or agents with power and authority as defined or limited in their respective powers of attorney, and to execute on behalf of the Corporation and affix the Corporation's seal thereto, bonds, undertakings, recognizances, contracts of indemnity and other written obligations in the nature thereof or related thereto; and (2) any such Officers of the Corporation may appoint and revoke the appointments of joint-control custodians, agents for acceptance of process, and Attorneys-in-fact with authority to execute waivers and consents on behalf of the Corporation; and (3) the signature of any such Officer of the Corporation and the Corporation's seal may be affixed by facsimile to any power of attorney or certification given for the execution of any bond, undertaking, recognizance, contract of indemnity or other written obligation in the nature thereof or related thereto, such signature and seals when so used whether heretofore or hereafter, being hereby adopted by the Corporation as the original signature of such officer and the original seal of the Corporation, to be valid and binding upon the Corporation with the same force and effect as though manually affixed."

IN WITNESS WHEREOF, INTERNATIONAL FIDELITY INSURANCE COMPANY and ALLEGHENY CASUALTY COMPANY have each executed and attested these presents on this 31st day of December, 2015.



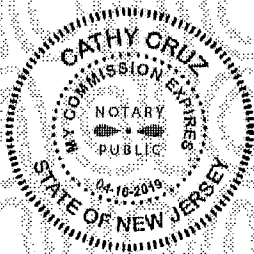
STATE OF NEW JERSEY
County of Essex

ROBERT W. MINSTER
Chief Executive Officer (International Fidelity Insurance Company) and President (Allegheny Casualty Company)



On this 31st day of December 2015, before me came the individual who executed the preceding instrument, to me personally known, and, being by me duly sworn, said he is the therein described and authorized officer of INTERNATIONAL FIDELITY INSURANCE COMPANY and ALLEGHENY CASUALTY COMPANY; that the seals affixed to said instrument are the Corporate Seals of said Companies; that the said Corporate Seals and his signature were duly affixed by order of the Boards of Directors of said Companies.

IN TESTIMONY WHEREOF, I have hereunto set my hand affixed my Official Seal, at the City of Newark, New Jersey the day and year first above written.



A NOTARY PUBLIC OF NEW JERSEY
My Commission Expires April 16, 2019

CERTIFICATION

I, the undersigned officer of INTERNATIONAL FIDELITY INSURANCE COMPANY and ALLEGHENY CASUALTY COMPANY do hereby certify that I have compared the foregoing copy of the Power of Attorney and affidavit, and the copy of the Sections of the By-Laws of said Companies as set forth in said Power of Attorney, with the originals on file in the home office of said companies, and that the same are correct transcripts thereof, and of the whole of the said originals, and that the said Power of Attorney has not been revoked and is now in full force and effect.

IN TESTIMONY WHEREOF, I have hereunto set my hand this 19th day of July, 2016.

MARIA BRANCO, Assistant Secretary

ATTACHMENTS

ATTACHMENT A
SCOPE OF WORK

SCOPE OF WORK

1. **SCOPE OF WORK:** *PHASE I* calls for the construction of approximately 1 AC skate park, connection between Cherokee Park & PDLC, by expanding the greenbelt, and associated accessible improvements within the park and around the former Copley YMCA building.

1.1 The Work shall be performed in accordance with:

- 1.1.1. The Notice Inviting Bids and Plans numbered **38888-01-D** through **38888-86-D**, inclusive.

2. **LOCATION OF WORK:** The location of the Work is as follows:

Refer to Appendix E – Location Map

3. **CONTRACT TIME:** The Contract Time for completion of the Work, including the Plant Establishment Period, shall be **231 Working Days**.

ATTACHMENT B
INTENTIONALLY LEFT BLANK

ATTACHMENT C
EQUAL OPPORTUNITY CONTRACTING PROGRAM

EQUAL OPPORTUNITY CONTRACTING PROGRAM REQUIREMENTS

1. To The WHITEBOOK, Chapter 10, Sections D and E, DELETE each in its entirety, and SUBSTITUTE with the following:

D. CITY'S EQUAL OPPORTUNITY COMMITMENT.

1. Nondiscrimination in Contracting Ordinance.

1. The Contractor, Subcontractors and Suppliers shall comply with requirements of the City's Nondiscrimination in Contracting Ordinance, San Diego Municipal Code §§22.3501 through 22.3517.

The Contractor shall not discriminate on the basis of race, gender, religion, national origin, ethnicity, sexual orientation, age, or disability in the solicitation, selection, hiring, or treatment of subcontractors, vendors, or suppliers. The Contractor shall provide equal opportunity for subcontractors to participate in subcontracting opportunities. The Contractor understands and agrees that violation of this clause shall be considered a material breach of the contract and may result in contract termination, debarment, or other sanctions.

The Contractor shall include the foregoing clause in all contracts between the Contractor and Subcontractors and Suppliers.

2. Disclosure of Discrimination Complaints. As part of its Bid or Proposal, the Bidder shall provide to the City a list of all instances within the past 10 years where a complaint was filed or pending against Bidder in a legal or administrative proceeding alleging that Bidder discriminated against its employees, subcontractors, vendors, or suppliers, and a description of the status or resolution of that complaint, including any remedial action taken.
3. Upon the City's request, the Contractor agrees to provide to the City, within 60 days, a truthful and complete list of the names of all Subcontractors and Suppliers that the Contractor has used in the past 5 years on any of its contracts that were undertaken within San Diego County, including the total dollar amount paid by the Contractor for each subcontract or supply contract.
4. The Contractor further agrees to fully cooperate in any investigation conducted by the City pursuant to the City's Nondiscrimination in Contracting Ordinance, Municipal Code §§22.3501 through 22.3517. The Contractor understands and agrees that violation of this clause shall be considered a material breach of the Contract and may result in remedies being ordered against the Contractor up to and including contract termination, debarment and other sanctions for violation of the provisions of the Nondiscrimination in Contracting Ordinance. The Contractor further understands and agrees that the procedures, remedies and sanctions provided for in the Nondiscrimination in Contracting Ordinance apply only to violations of the Ordinance.

E. EQUAL EMPLOYMENT OPPORTUNITY OUTREACH PROGRAM.

1. The Contractor, Subcontractors and Suppliers shall comply with the City's Equal Employment Opportunity Outreach Program, San Diego Municipal Code §§22.2701 through 22.2707.

The Contractor shall not discriminate against any employee or applicant for employment on any basis prohibited by law. Contractor shall provide equal opportunity in all employment practices. Prime Contractor shall ensure their subcontractors comply with this program. Nothing in this section shall be interpreted to hold a prime contractor liable for any discriminatory practice of its subcontractors.

The Contractor shall include the foregoing clause in all contracts between the Contractor and Subcontractors and Suppliers.

2. If the Contract is competitively solicited, the selected Bidder shall submit a Work Force Report (Form BB05), within 10 Working Days after receipt by the Bidder of Contract forms to the City for approval as specified in the Notice of Intent to Award letter from the City.
3. If a Work Force Report is submitted, and the City determines there are under-representations when compared to County Labor Force Availability data, the selected Bidder shall submit an Equal Employment Opportunity Plan.
4. If the selected Bidder submits an Equal Employment Opportunity Plan, it shall include the following assurances:
 1. The Contractor shall maintain a working environment free of discrimination, harassment, intimidation and coercion at all sites and in all facilities at which the Contractor's employees are assigned to work.
 2. The Contractor reviews its EEO Policy, at least annually, with all on-site supervisors involved in employment decisions.
 3. The Contractor disseminates and reviews its EEO Policy with all employees at least once a year, posts the policy statement and EEO posters on all company bulletin boards and job sites, and documents every dissemination, review and posting with a written record to identify the time, place, employees present, subject matter, and disposition of meetings.
 4. The Contractor reviews, at least annually, all supervisors' adherence to and performance under the EEO Policy and maintains written documentation of these reviews.
 5. The Contractor discusses its EEO Policy Statement with subcontractors with whom it anticipates doing business, includes the EEO Policy Statement in its subcontracts, and provides such documentation to the City upon request.

6. The Contractor documents and maintains a record of all bid solicitations and outreach efforts to and from subcontractors, contractor associations and other business associations.
7. The Contractor disseminates its EEO Policy externally through various media, including the media of people of color and women, in advertisements to recruit, maintains files documenting these efforts, and provides copies of these advertisements to the City upon request.
8. The Contractor disseminates its EEO Policy to union and community organizations.
9. The Contractor provides immediate written notification to the City when any union referral process has impeded the Contractor's efforts to maintain its EEO Policy.
10. The Contractor maintains a current list of recruitment sources, including those outreaching to people of color and women, and provides written notification of employment opportunities to these recruitment sources with a record of the organizations' responses.
11. The Contractor maintains a current file of names, addresses and phone numbers of each walk-in applicant, including people of color and women, and referrals from unions, recruitment sources, or community organizations with a description of the employment action taken.
12. The Contractor encourages all present employees, including people of color and women employees, to recruit others.
13. The Contractor maintains all employment selection process information with records of all tests and other selection criteria.
14. The Contractor develops and maintains documentation for on-the-job training opportunities, participates in training programs, or both for all of its employees, including people of color and women, and establishes apprenticeship, trainee, and upgrade programs relevant to the Contractor's employment needs.
15. The Contractor conducts, at least annually, an inventory and evaluation of all employees for promotional opportunities and encourages all employees to seek and prepare appropriately for such opportunities.
16. The Contractor ensures the company's working environment and activities are non-segregated except for providing separate or single-user toilets and necessary changing facilities to assure privacy between the sexes.

ATTACHMENT D
PREVAILING WAGES

1. **PREVAILING WAGE RATES:** Pursuant to San Diego Municipal Code section 22.3019, construction, alteration, demolition, repair and maintenance work performed under this Contract is subject to State prevailing wage laws. For construction work performed under this Contract cumulatively exceeding \$25,000 and for alteration, demolition, repair and maintenance work performed under this Contract cumulatively exceeding \$15,000, the Contractor and its subcontractors shall comply with State prevailing wage laws including, but not limited to, the requirements listed below.
 - 1.1. **Compliance with Prevailing Wage Requirements.** Pursuant to sections 1720 through 1861 of the California Labor Code, the Contractor and its subcontractors shall ensure that all workers who perform work under this Contract are paid not less than the prevailing rate of per diem wages as determined by the Director of the California Department of Industrial Relations (DIR). This includes work performed during the design and preconstruction phases of construction including, but not limited to, inspection and land surveying work.
 - 1.1.1. Copies of such prevailing rate of per diem wages are on file at the City and are available for inspection to any interested party on request. Copies of the prevailing rate of per diem wages also may be found at <http://www.dir.ca.gov/OPRL/DPreWageDetermination.htm>. Contractor and its subcontractors shall post a copy of the prevailing rate of per diem wages determination at each job site and shall make them available to any interested party upon request.
 - 1.1.2. The wage rates determined by the DIR refer to expiration dates. If the published wage rate does not refer to a predetermined wage rate to be paid after the expiration date, then the published rate of wage shall be in effect for the life of this Contract. If the published wage rate refers to a predetermined wage rate to become effective upon expiration of the published wage rate and the predetermined wage rate is on file with the DIR, such predetermined wage rate shall become effective on the date following the expiration date and shall apply to this Contract in the same manner as if it had been published in said publication. If the predetermined wage rate refers to one or more additional expiration dates with additional predetermined wage rates, which expiration dates occur during the life of this Contract, each successive predetermined wage rate shall apply to this Contract on the date following the expiration date of the previous wage rate. If the last of such predetermined wage rates expires during the life of this Contract, such wage rate shall apply to the balance of the Contract.
- 1.2. **Penalties for Violations.** Contractor and its subcontractors shall comply with California Labor Code section 1775 in the event a worker is paid less than the prevailing wage rate for the work or craft in which the worker is employed.
- 1.3. **Payroll Records.** Contractor and its subcontractors shall comply with California Labor Code section 1776, which generally requires keeping accurate payroll records, verifying and certifying payroll records, and making them available for inspection. Contractor shall require its subcontractors to also comply with section 1776. Contractor and its subcontractors shall submit weekly certified payroll records online via the City's web-based Labor Compliance Program. Contractor is responsible for ensuring its subcontractors submit certified payroll records to the City.

- 1.3.1.** For contracts entered into on or after April 1, 2015, Contractor and their subcontractors shall furnish records specified in Labor Code section 1776 directly to the Labor Commissioner in the manner required by Labor Code section 1771.4.
- 1.4. Apprentices.** Contractor and its subcontractors shall comply with California Labor Code sections 1777.5, 1777.6 and 1777.7 concerning the employment and wages of apprentices. Contractor is held responsible for the compliance of their subcontractors with sections 1777.5, 1777.6 and 1777.7.
- 1.5. Working Hours.** Contractor and their subcontractors shall comply with California Labor Code sections 1810 through 1815, including but not limited to: (i) restrict working hours on public works contracts to eight hours a day and forty hours a week, unless all hours worked in excess of 8 hours per day are compensated at not less than 1½ times the basic rate of pay; and (ii) specify penalties to be imposed on design professionals and subcontractors of \$25 per worker per day for each day the worker works more than 8 hours per day and 40 hours per week in violation of California Labor Code sections 1810 through 1815.
- 1.6. Required Provisions for Subcontracts.** Contractor shall include at a minimum a copy of the following provisions in any contract they enter into with a subcontractor: California Labor Code sections 1771, 1771.1, 1775, 1776, 1777.5, 1810, 1813, 1815, 1860 and 1861.
- 1.7. Labor Code Section 1861 Certification.** Contractor in accordance with California Labor Code section 3700 is required to secure the payment of compensation of its employees and by signing this Contract, Contractor certifies that “I am aware of the provisions of Section 3700 of the California Labor Code which require every employer to be insured against liability for workers’ compensation or to undertake self-insurance in accordance with the provisions of that code, and I will comply with such provisions before commencing the performance of the work of this Contract.”
- 1.8. Labor Compliance Program.** The City has its own Labor Compliance Program authorized in August 2011 by the DIR. The City will withhold contract payments when payroll records are delinquent or deemed inadequate by the City or other governmental entity, or it has been established after an investigation by the City or other governmental entity that underpayment(s) have occurred. For questions or assistance, please contact the City of San Diego’s Equal Opportunity Contracting Department at 619-236-6000.
- 1.9. Contractor and Subcontractor Registration Requirements.** This project is subject to compliance monitoring and enforcement by the DIR. As of March 1, 2015, no contractor or subcontractor may be listed on a bid or proposal for a public works project unless registered with the DIR pursuant to Labor Code section 1725.5. As of April 1, 2015, a contractor or subcontractor shall not be qualified to bid on, be listed in a bid proposal, or enter into any contract for public work, unless currently registered and qualified to perform public work pursuant to Labor Code section 1725.5. By submitting a bid or proposal to the City, Contractor is certifying that he or she has verified that all subcontractors used on this public work project are registered with the DIR in compliance with Labor Code sections 1771.1 and 1725.5, and Contractor shall provide proof of registration to the City upon request.

- 1.9.1.** A Contractor's inadvertent error in listing a subcontractor who is not registered pursuant to Labor Code section 1725.5 in response to a solicitation shall not be grounds for filing a bid protest or grounds for considering the bid non-responsive provided that any of the following apply: (1) the subcontractor is registered prior to bid opening; (2) within twenty-four hours after the bid opening, the subcontractor is registered and has paid the penalty registration fee specified in Labor Code section 1725.5; or (3) the subcontractor is replaced by another registered subcontractor pursuant to Public Contract Code section 4107.

ATTACHMENT E
SUPPLEMENTARY SPECIAL PROVISIONS

SUPPLEMENTARY SPECIAL PROVISIONS

The following Supplementary Special Provisions (SSP) modifies the following documents:

- 1) Standard Specifications for Public Works Construction (The GREENBOOK) currently in effect.
 - 2) The City of San Diego Standard Specifications for Public Works Construction (The WHITEBOOK).
-

SECTION 1 – TERMS, DEFINITIONS, ABBREVIATIONS, UNITS OF MEASURE, AND SYMBOLS

1-2 TERMS AND DEFINITIONS.

Normal Working Hours. To the City Supplement, ADD the following:

The Normal Working Hours are **7:00 AM to 3:30 PM.**

SECTION 2 - SCOPE AND CONTROL OF WORK

2-3.2 Self Performance. DELETE in its entirety and SUBSTITUTE with the following:

1. You must perform, with your own organization, Contract work amounting to at least 50% of the base bid alone or base bid and any additive or deductive alternate(s) that together when added or deducted form the basis of award.

2-5.3.1 General. To the City Supplement, ADD the following:

7. For products for which an AML is available, products listed in the AML shall be used. A submittal review will be conducted for products not identified on an AML on a case-by-case basis when:
 - a) The product type or category is not in the AML.
 - b) The AML does not list at least two available manufacturers of the product.
 - c) The material or manufacturer listed in the AML is no longer available. Documentation to substantiate the product is no longer available or in production is required as part of the submittal.

In the case of conducting a submittal review when required by the Plans or Special Provisions, or when requested by the Engineer, all submittals shall be accompanied by the City's submittal form.

The Product Submittal Form is available for download at:

<http://www.sandiego.gov/publicworks/edocref/index.shtml>

2-5.4.1 General. To the City Supplement, ADD the following

6. City will prepare final mylar as-built drawings after review and approval of red-lined record set.

2-5.4.2 Asset Specific Redlines. To the City Supplement, ADD the following

8. Controller Charts: As-built record drawings shall be approved by the City before Contractor prepares controller charts.
 - a) Provide two controller charts for each controller installed.
 - b) A reduced copy of the approved as-built irrigation plan, color coded by stations and laminated in plastic, shall be provided at 11x17 size (to Park and Recreation Department) and at the maximum size that will fit inside the controller enclosure at the time of final acceptance.
 - c) Charts shall be reduced plans of as-built systems. If control circuits are not legible when plans are reduced, then they shall be enlarged to a size that will be readable when reduced.
 - d) Charts shall be blackline prints, and different colors shall be used to indicate area of coverage for each station.
 - e) After approval by the City, charts shall be hermetically sealed between two pieces of plastic-minimum 10 mils. thick each.
 - f) Charts shall be completed and approved by the City prior to final inspection of irrigation system.
9. Operation and Maintenance Manuals: Prepare and deliver to the City within ten calendar days prior to completion of construction, two hard cover binders with three rings containing the following information:
 - a) Index sheet stating Contractor's address and telephone number, list of equipment with name and address of local manufacturers' representatives.
 - b) Catalog and parts sheets on material and equipment installed under this contract.
 - c) Guarantee statement (refer to Subsection 308-7, Guarantee).
 - d) Complete operating and maintenance instruction manuals on major equipment.
 - e) In addition to required maintenance manuals, provide the City's maintenance personnel with instructions for major equipment and show evidence in writing to the City at the conclusion of the project that this service has been rendered.

2-7

SUBSURFACE DATA. ADD the following:

4. In preparation of the Contract Documents, the designer has relied upon the following reports of explorations and tests of subsurface conditions at the Work Site:
 - a) Soils Investigation, dated December 10, 2014 by K2 Engineering.
5. The report listed above is available for review by contacting the Contract Specialist. See also Appendix F.

2-9.1

Permanent Survey Markers. To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

1. Pursuant to Division 3, Chapter 15 of the Business and Professions Code, you shall not disturb survey monuments that “control the location of subdivisions, tracts, boundaries, roads, streets, or highways, or provide horizontal or vertical survey control” until they have been tied out by a Registered Land Surveyor or Registered Civil Engineer authorized to practice land surveying within the State of California.
2. Monument Preservation shall be performed by the City’s Construction Management and Field Services (CMFS) Division on all Projects, unless permission is obtained for these services in writing by CMFS.
3. You shall submit to the Engineer a minimum of 7 Days prior to the start of the Work a list of controlling survey monuments which may be disturbed. CMFS shall do the following:
 - a) Set survey points outside the affected Work area that reference and locate each controlling survey monument that may be disturbed.
 - b) File a Corner Record or Record of Survey with the County Surveyor after setting the survey points to be used for re-establishment of the disturbed controlling survey monuments.
 - c) File a Corner Record of Record of Survey with the County Surveyor after re-establishment of the disturbed controlling survey monuments.

2-9.2

Survey Service. DELETE in its entirety and SUBSTITUTE with the following:

1. Prior to the start of construction, you shall submit a letter to the Engineer identifying the Licensed Land Surveyor or the Registered Civil Engineer authorized to practice land surveying within the State of California that will be performing the survey services for the Project.
2. You are responsible for performing and meeting the accuracy of surveying standards adequate for construction through a Licensed Land Surveyor or a Registered Civil Engineer authorized to practice land surveying within the State of California.

3. Survey stakes shall be set and stationed by you for curbs, headers, water mains, sewers, storm drains, structures, rough grade, and any other structures and appurtenances that are needed for the Project. A corresponding cut or fill to finished grade (or flow line) shall be indicated on a grade sheet.
4. Surveys performed shall list the basis of bearings as tied to Record of Survey 14492 or equivalent, based on the California Coordinate System of 1983, Zone 6, U.S. Survey foot, epoch 1991.35, along with a completed calibration sheet (blank form will be supplied by City Surveys). The vertical datum used shall be NGVD 29 in accordance with the City of San Diego Vertical Bench Book.
5. You shall preserve construction survey stakes, control points, and other survey related marks for the duration of the Project. If any construction survey stakes are lost or disturbed and need to be replaced, such replacement shall be performed by the Engineer at your expense.

2-9.2.1 Survey Files.

1. All Computer Aided Drafting (CAD) Work shall be done in accordance with the City of San Diego's Citywide Computer Aided Design and Drafting (CADD) Standards and shall be in City seed files (.job, .txt, .dgn, .alg, .raw, .fwd, .dtm, .pdf, .docx, .xlsx, .tif, and .jpg).
2. All survey files shall be completed in accordance with the City of San Diego's Citywide CADD Standards and shall adhere to the City's Microstation level and attribute structure.
3. The survey file deliverable will be either one Master .dgn file containing all xref's in geospatially referenced (and attached) models or one Master dgn with all xref's geospatially referenced (and attached) as dgn files. Resource files may be sent to you if requested.
4. Survey files shall include, but shall not be limited to, the following items:
 - a. Street center line and (record width) right-of-way lines.
 - b. Project geometry (.alg) files (this will be generated for use in InRoads).
 - c. 3D surface model (.dtm, break line and spot elevation) file.
 - d. Spot elevations of the new utility main at each intersection, midblocks, and for any change in grade.
 - e. Monuments.
 - f. Curb lines (top curb and gutter).
 - g. All other appurtenances including but not limited to water valves, meters, vaults, manholes, fire hydrants, utility boxes, cleanouts, and poles.

5. You shall use the survey information to produce red-lines drawings as described in Section 2-5.4 “Red-lines and Record Documents.”

2-9.2.2 Submittal.

1. Survey files shall be submitted in accordance with 2-5.3, “Submittals” and 2-5.4, “Red-Lines and Record Documents”. You shall provide the Survey Files, proposed Drawings, and/or Red-line Drawings on a CD/DVD to the Engineer and shall post the Survey Files, proposed Drawings, and/or Red-line Drawings to the following website:

<ftp://ftp.sannet.gov/IN/SURVEYS/>

2. After the documents have been posted to the website, you shall send a confirmation email, which includes the hyperlink to the website, to the Engineer and to SurveyReview@sandiego.gov.
3. All survey Work and submittals which reveal non-compliance with the requirements of the Construction Documents shall be corrected as deemed necessary by the Engineer and the cost of the corrections to your survey submittals shall be at your expense.

2-9.2.3 Payment.

1. The payment for survey services Work shall be included in the lump sum Bid item for “Survey Services”.

2-15 TECHNICAL STUDIES AND DATA. To the City Supplement, ADD the following:

5. In preparation of the Contract Documents, the designer has relied upon the following reports of explorations and tests at the Work Site:
 1. Water Quality Technical Report, dated July 6, 2015 by O’Day Consultants.
6. The report listed above is available for review by contacting the Contract Specialist. See also Appendix G.

SECTION 4 - CONTROL OF MATERIALS

4-1.3.6 Preapproved Materials. To the City Supplement, ADD the following:

3. You shall submit in writing a list of all products to be incorporated in the Work that are on the AML.

4-1.6 Trade Names or Equals. ADD the following:

14. You shall submit your list of proposed substitutions for an “equal” item **no later than 5 Working Days after the determination of the Apparent Low Bidder** and on the City’s Product Submittal Form available at:

<http://www.sandiego.gov/publicworks/edoeref/index.shtml>

4-1.10

Foreign Materials. To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

1. Materials that are manufactured, produced, or fabricated outside of the United States shall be delivered to a distribution point in California, unless otherwise specified. Quality Control and related testing shall be performed to all applicable specified US standards. Manufacturer's testing and staff certification shall be traceable to a United States regulatory agency. Retain the materials for a sufficient period of time to permit inspection, sampling, and testing. You shall not be entitled to an extension of time for acts or events occurring outside of, at point of entry, or during transport to the United States.

SECTION 5 – UTILITIES

5-2

PROTECTION. ADD the following:

1. You shall repair or replace traffic signal and lighting system equipment within 72 hours after notification of defects by the Engineer.
2. While working in or around meter boxes, you shall protect in place all Advanced Metering Infrastructure (AMI) devices attached to the water meter or located in or near water meter boxes, coffins, or vaults. This includes any antenna installed through the meter box lid.
 - a) Avoid damaging the antenna, cable, and endpoints when removing the meter box lid and when disconnecting AMI endpoints from the register on top of the water meter.
 - b) If meters or AMI devices need to be removed or relocated, the AMI endpoints shall be reinstalled with the Encoder/Receiver/Transmitter (ERT) pointing upwards.
 - c) Because the AMI equipment is uniquely matched to each service location and to specific meter serial numbers, any AMI devices that are removed or disconnected shall be reinstalled on the same service lateral as well as to the same meter serial number it was attached to originally.
 - d) Do not change or modify the lid if the lid has an antenna drilled through it.
 - e) If you encounter damaged, disconnected, buried, or broken AMI endpoints, cables between the registers, antennae, lids, or ERTs, notify the Engineer within 24 hours.
 - f) Any AMI equipment damaged by you shall be repaired or replaced by City Forces at your expense.

SECTION 6 - PROSECUTION, PROGRESS AND ACCEPTANCE OF WORK

6-1.1 Construction Schedule. To item 20, ADD the following:

The 90 Calendar Day for the Plant Establishment Period is included in the stipulated Contract Time.

6-8.3 Warranty. ADD the following:

Manufacturer's warranties shall not relieve the Contractor of his liability under the guarantee. Such warranties shall only supplement the guarantee.

SECTION 7 - RESPONSIBILITIES OF THE CONTRACTOR

7-3 LIABILITY INSURANCE. DELETE in its entirety and SUBSTITUTE with the following:

The insurance provisions herein shall not be construed to limit your indemnity obligations contained in the Contract.

7-3.1 Policies and Procedures.

1. You must procure the insurance described below, at its sole cost and expense, to provide coverage against claims for loss including injuries to persons or damage to property, which may arise out of or in connection with the performance of the Work by you, your agents, representatives, officers, employees or Subcontractors.
2. Insurance coverage for property damage resulting from your operations is on a replacement cost valuation. The market value will not be accepted.
3. You shall maintain this insurance for the duration of this Contract and at all times thereafter when you are correcting, removing, or replacing Work in accordance with this Contract. Your liabilities under the Contract, e.g., your indemnity obligations, is not deemed limited to the insurance coverage required by this Contract.
4. The payment for insurance shall be included in the Contract Price as bid by you. Except as specifically agreed to by the City in writing, you are not entitled to any additional payment. Do not begin any Work under this Contract until you have provided and the City has approved all required insurance.
5. Policies of insurance shall provide that the City is entitled to 30 Days (10 Days for cancellation due to non-payment of premium) prior written notice of cancellation or non-renewal of the policy. Maintenance of specified insurance coverage is a material element of the Contract. Your failure to maintain or renew coverage or to provide evidence of renewal during the term of the Contract may be treated by the City as a material breach of the Contract.

7-3.2 Types of Insurance.

7-3.2.1 Commercial General Liability Insurance.

1. Commercial General Liability Insurance shall be written on the current version of the ISO Occurrence form CG 00 01 07 98 or an equivalent form providing coverage at least as broad.
2. The policy shall cover liability arising from premises and operations, XCU (explosions, underground, and collapse), independent contractors, products/completed operations, personal injury and advertising injury, bodily injury, property damage, and liability assumed under an insured's contract (including the tort liability of another assumed in a business contract).
3. There shall be no endorsement or modification limiting the scope of coverage for either "insured vs. insured" claims or contractual liability. You shall maintain the same or equivalent insurance for at least 10 years following completion of the Work.
4. All costs of defense shall be outside the policy limits. Policy coverage shall be in liability limits of not less than the following:

<u>General Annual Aggregate Limit</u>	<u>Limits of Liability</u>
Other than Products/Completed Operations	\$2,000,000
Products/Completed Operations Aggregate Limit	\$2,000,000
Personal Injury Limit	\$1,000,000
Each Occurrence	\$1,000,000

7-3.2.2 Commercial Automobile Liability Insurance.

1. You shall provide a policy or policies of Commercial Automobile Liability Insurance written on the current version of the ISO form CA 00 01 12 90 or later version or equivalent form providing coverage at least as broad in the amount of \$1,000,000 combined single limit per accident, covering bodily injury and property damage for owned, non-owned, and hired automobiles ("Any Auto").
2. All costs of defense shall be outside the limits of the policy.

7-3.3 Rating Requirements. Except for the State Compensation Insurance Fund, all insurance required by this Contract as described herein shall be carried only by responsible insurance companies with a rating of, or equivalent to, at least "A-, VI" by A.M. Best Company, that are authorized by the California Insurance Commissioner to do business in the State, and that have been approved by the City.

7-3.3.1 Non-Admitted Carriers. The City will accept insurance provided by non-admitted, "surplus lines" carriers only if the carrier is authorized to do business in the State and is included on the List of Approved Surplus Lines Insurers (LASLI list).

All policies of insurance carried by non-admitted carriers shall be subject to all of the requirements for policies of insurance provided by admitted carriers described herein.

7-3.4 Evidence of Insurance. Furnish to the City documents e.g., certificates of insurance and endorsements evidencing the insurance required herein, and furnish renewal documentation prior to expiration of this insurance. Each required document shall be signed by the insurer or a person authorized by the insurer to bind coverage on its behalf. We reserve the right to require complete, certified copies of all insurance policies required herein.

7-3.5 Policy Endorsements.

7-3.5.1 Commercial General Liability Insurance

7-3.5.1.1 Additional Insured.

- a) You shall provide at your expense policy endorsement written on the current version of the ISO Occurrence form CG 20 10 11 85 or an equivalent form providing coverage at least as broad.
- b) To the fullest extent allowed by law e.g., California Insurance Code §11580.04, the policy shall be endorsed to include the City and its respective elected officials, officers, employees, agents, and representatives as additional insured.
- c) The additional insured coverage for projects for which the Engineer's Estimate is \$1,000,000 or more shall include liability arising out of:
 - a) Ongoing operations performed by you or on your behalf,
 - b) your products,
 - c) your Work, e.g., your completed operations performed by you or on your behalf, or
 - d) premises owned, leased, controlled, or used by you.
- d) The additional insured coverage for projects for which the Engineer's Estimate is less than \$1,000,000 shall include liability arising out of:
 - a) Ongoing operations performed by you or on your behalf,
 - b) your products, or
 - c) premises owned, leased, controlled, or used by you.

7-3.5.1.2 Primary and Non-Contributory Coverage. The policy shall be endorsed to provide that the coverage with respect to operations, including the completed operations, if appropriate, of the Named Insured is primary to any insurance or self-insurance of the City and its elected officials, officers, employees, agents and representatives. Further, it shall provide that any insurance maintained by the City and its elected officials, officers, employees, agents and representatives shall be in excess of your insurance and shall not contribute to it.

- 7-3.5.1.3 Project General Aggregate Limit.** The policy or policies shall be endorsed to provide a Designated Construction Project General Aggregate Limit that will apply only to the Work. Only claims payments which arise from the Work shall reduce the Designated Construction Project General Aggregate Limit. The Designated Construction Project General Aggregate Limit shall be in addition to the aggregate limit provided for the products-completed operations hazard.
- 7-3.5.2 Commercial Automobile Liability Insurance.**
- 7-3.5.2.1 Additional Insured.** Unless the policy or policies of Commercial Auto Liability Insurance are written on an ISO form CA 00 01 12 90 or a later version of this form or equivalent form providing coverage at least as broad, the policy shall be endorsed to include the City and its respective elected officials, officers, employees, agents, and representatives as additional insured, with respect to liability arising out of automobiles owned, leased, hired or borrowed by you or on your behalf. This endorsement is limited to the obligations permitted by California Insurance Code §11580.04.
- 7-3.6 Deductibles and Self-Insured Retentions.** You shall pay for all deductibles and self-insured retentions. You shall disclose deductibles and self-insured retentions to the City at the time the evidence of insurance is provided.
- 7-3.7 Reservation of Rights.** The City reserves the right, from time to time, to review your insurance coverage, limits, deductibles and self-insured retentions to determine if they are acceptable to the City. The City will reimburse you, without overhead, profit, or any other markup, for the cost of additional premium for any coverage requested by the Engineer but not required by this Contract.
- 7-3.8 Notice of Changes to Insurance.** You shall notify the City 30 Days prior to any material change to the policies of insurance provided under this Contract.
- 7-3.9 Excess Insurance.** Policies providing excess coverage shall follow the form of the primary policy or policies e.g., all endorsements.
- 7-3.10 Architects and Engineers Professional Insurance (Errors and Omissions Insurance).**
1. For Contracts with required engineering services (e.g., Design-Build, preparation of engineered Traffic Control Plans (TCP), and etc) by you, you shall keep or require all of your employees or Subcontractors, who provide professional engineering services under this contract, Professional Liability coverage with a limit of \$1,000,000 per claim and \$2,000,000 annual aggregate in full force and effect.
 2. You shall ensure the following:
 - a) The policy retroactive date is on or before the date of commencement of the Project.
 - b) The policy will be maintained in force for a period of 3 years after completion of the Project or termination of this Contract, whichever occurs last. You agree that for the time period specified above, there will be no changes or endorsements to the policy that affect the specified coverage.

3. If professional engineering services are to be provided solely by the Subcontractor, you shall:
 - a) Certify this to the City in writing and
 - b) Agree in writing to require the Subcontractor to procure Professional Liability coverage in accordance with the requirements set forth above.

7-4 WORKERS' COMPENSATION INSURANCE. DELETE in its entirety and SUBSTITUTE with the following:

7-4.1 Workers' Compensation Insurance and Employers Liability Insurance.

1. In accordance with the provisions of §3700 of the California Labor Code, you shall provide at your expense Workers' Compensation Insurance and Employers Liability Insurance to protect you against all claims under applicable state workers compensation laws. The City, its elected officials, and employees will not be responsible for any claims in law or equity occasioned by your failure to comply with the requirements of this section.
2. Limits for this insurance shall be not less than the following:

<u>Workers' Compensation</u>	<u>Statutory Employers Liability</u>
Bodily Injury by Accident	\$1,000,000 each accident
Bodily Injury by Disease	\$1,000,000 each employee
Bodily Injury by Disease	\$1,000,000 policy limit

3. By signing and returning the Contract you certify that you are aware of the provisions of §3700 of the Labor Code which requires every employer to be insured against liability for worker's compensation or to undertake self-insurance in accordance with the provisions of that code and you shall comply with such provisions before commencing the Work as required by §1861 of the California Labor Code.

7-4.1.1 Waiver of Subrogation. The policy or policies shall be endorsed to provide that the insurer will waive all rights of subrogation against the City and its respective elected officials, officers, employees, agents, and representatives for losses paid under the terms of the policy or policies and which arise from Work performed by the Named Insured for the City.

7-5 PERMITS, FEES, AND NOTICES. To the City Supplement, ADD the following:

The City will obtain, at no cost to you, the following permits:

1. Electrical
2. Structural
3. Building Permit

7-10.5.3 Steel Plate Covers. Table 7-10.5.3 (A), REVISE the plate thickness for 5'-3" trench width to read 1³/₄".

7-15 INDEMNIFICATION AND HOLD HARMLESS AGREEMENT. To the City Supplement, Paragraph (4), Sentence (3), DELETE in its entirety and SUBSTITUTE with the following:

Your duty to indemnify and hold harmless does not include any claims or liability arising from the established active or sole negligence, or willful misconduct of the City, its officers, or employees.

7-16 COMMUNITY LIAISON. To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

ADD:

7-16 COMMUNITY OUTREACH.

7-16.1 General.

1. To ensure consistency with the City's community outreach plan for the project, the City shall work with you to inform the public (which includes, but shall not be limited to, property owners, renters, homeowners, business owners, recreational users, and other community members and stakeholders) of construction impacts. Your efforts to mitigate construction impacts by communicating with the public require close coordination and cooperation with the City.
2. You shall perform the community outreach activities required throughout the Contract Time. You shall assign a staff member who shall perform the required community outreach services.
3. You shall closely coordinate the Work with the businesses, institutions, residents, and property owners impacted by the Project.
4. Your example duties include notifying businesses, institutions, and residents of the commencement of construction activities not less than 5 Days in advance, coordinating access for vehicular and pedestrian traffic to businesses, institutions, and residences impacted by the Project, reporting activities at all Project progress meetings scheduled by the Engineer, attending the Project Pre-construction meeting, attending 2 community meetings, responding to community questions and complaints related to your activities, and documenting, in writing, as well as logging in all inquiries and complaints received into the City's internal public contact tracking system.
5. You shall execute the Information Security Policy (ISP) Acknowledgement Form - For Non-City Employees within 15 Days of the award of the Contract if any of the following apply:
 - a) Your contact information is made available on any outreach materials.

- b) You will be the primary point of contact to resolve project related inquiries and complaints.

6. Electronic Communication.

- a) All inquiries and complaints shall be logged in to the City's internal public contact tracking system within 24 hours of receipt of inquiries and complaints.
- b) Any updates or a resolution of inquiries and complaints shall be documented in the City's internal public contact tracking system within 24 hours.
- c) Copies of email communications shall be saved individually on to the City's internal public contact tracking system in an Outlook Message Format (*.msg).
- d) All graphics, photos, and other electronic files associated with inquiries and/or complaints shall be saved into the individual records, located within the City's internal public contact tracking system.

7-16.1.1 Quality Assurance.

- 1. During the course of community outreach, you shall ensure that the character of all persons that conduct community outreach (distributing door hangers, attending community meetings, interacting with the public, and etc.) on your behalf shall:
 - a. Have the ability to speak and comprehend English and/or Spanish, as appropriate for the community or public they are informing.
 - b. Possess and display easily verifiable and readable personal identification that identifies the person as your employee.
 - c. Have the interpersonal skills to effectively, professionally, and tactfully represent you, the project, and the City to the public.

7-16.1.2 Submittals.

- 1. You shall submit to the Resident Engineer, for review and approval, all drafts of letters, notices, postcards, door hangers, signs, mailing lists, proposed addresses for hand-delivery, and any other notices and letters that are to be mailed and or distributed to the public.
 - a. Prior to distributing or mailing, you shall submit final drafts of letters, notices, postcards, door hangers, signs, and any other notices and letters to the Resident Engineer for final review and approval. Submit a PDF copy of the approved door hangers to the Engineer.

- b. After distributing or mailing, you shall submit verification of delivery and any copies of returned notices to the Resident Engineer. Submit a PDF copy of the approved letters and notices to the Engineer.
2. You shall use the City's internal public contact tracking system to identify and summarize communications (via phone, in person, and email) with the public within 24 hours of receipt, even if your response to the individual is still incomplete. You shall upload to the City's internal public contact tracking system copies of all written, electronic, and verbal communications and conversations with the public.

7-16.2 Community Outreach Services.

7-16.2.1 Public Notice by Contractor.

1. Post Project Identification Signs in accordance with 7-10.6.2, "Project Identification Sign".
2. Notify businesses, institutions, property owners, residents or any other impacted stakeholders, within a minimum 300 feet (90 m) radius of the Project, of construction activities and utility service interruptions not less than 5 Days in advance.
3. Furnish and distribute public notices in the form of door hangers using the City's format to all occupants and/or property owners along streets:
 - a. Where Work is to be performed at least 5 Days before starting construction or survey activities or impacting the community as approved by the Resident Engineer.
 - b. Within 5 Days of the completion of your construction activities where Work was performed, you shall distribute public notices in the form of door hangers, which outlines the anticipated dates of Asphalt Resurfacing or Slurry Seal.
 - c. No less than 48 hours in advance and no more than 72 hours in advance of the scheduled resurfacing.
4. Leave the door hanger notices on or at the front door of each dwelling and apartment unit and at each tenant of commercial buildings abutting each of the street block segments. Where the front doors of apartment units are inaccessible, distribute the door hanger notices to the apartment manager or security officer.
5. Door Hanger Material: You shall use Blanks/USA brand, Item Number DHJ5B6WH, 1¼ inch (31.8 mm) Holes (removed), 2-up Jumbo Door Hanger in Bristol White, or approved equal.
6. Mailed Notice Material: You shall use Cougar by Domtar, Item Number 2834, or approved equal.

7. For all Work on private property, contact each owner and occupant individually a minimum of 15 Days prior to the Work. If the Work has been delayed, re-notify owners and occupants of the new Work schedule, as directed by the Resident Engineer.
8. A sample of public notices is included in the Contract Appendix.

7-16.2.2 Communications with the Public.

1. Coordinate access for vehicular and pedestrian traffic to businesses, institutions, and residences impacted by the Project.
2. You shall provide updates on construction impacts to the Resident Engineer. You shall notify the Resident Engineer in advance about time-sensitive construction impacts and may be required to distribute construction impact notices to the public on short notice.
3. You shall incorporate community outreach activities related to construction impacts in the baseline schedule and update the Resident Engineer with each week's submittal of the Three-Week Look Ahead Schedule.
4. At the request of the Resident Engineer, you shall attend and participate in project briefings at community meetings.
5. You shall coordinate with the Resident Engineer on all responses and actions taken to address public inquiries and complaints within the 24 hours that they are received.

7-16.2.3 Communications with Media.

1. The City may allow members of the media access to its construction site(s) on a case-by-case basis only.
2. Occasionally, uninvited members of the media may show up at construction Sites. Members of the media (including, but not limited to newspapers, magazines, radios, television, bloggers, and videographers) do not have the legal right to be in the construction Site without the City's permission.
3. In the event that media representatives arrive near or on the construction Site(s), you shall keep them off the Site(s) in a courteous and professional manner until a Public Information Officer is available to meet them at an approved location.
4. You shall report all visits from members of the media to the Resident Engineer as quickly as possible so that the City's Public Information Officer can meet with the members of the media at the construction Site(s).
5. If the City allows members of the media to access a construction Site, you shall allow the City to escort the media representatives while they are on the construction Site and shall ensure their safety.

6. You shall require media representatives to sign in and out of the Site Visitor Log and to use personal protective equipment.
7. You have a right to speak to members of the media about your company and its role on the project. All other questions shall be referred to the City.

7-16.4 Payment.

1. The payment for the community outreach services shall be included in the Contract Price.

7-20 ELECTRONIC COMMUNICATION. ADD the following:

1. Virtual Project Manager will be used on this contract.

SECTION 9 - MEASUREMENT AND PAYMENT

9-3.2.5 Withholding of Payment. To the City Supplement, item 1, subsection i), DELETE in its entirety and SUBSTITUTE with the following:

- i) Your failure to comply with 7-2.3, "PAYROLL RECORDS" and 2-16, "CONTRACTOR REGISTRATION AND ELECTRONIC REPORTING SYSTEM".

ADD:

9-3.7 Compensation Adjustments for Price Index Fluctuations. To the City Supplement, subsection c), item 2, DELETE in its entirety and SUBSTITUTE with the following:

- 2) In the event of an overrun of Contract time, adjustment in compensation for asphalt binder included in estimates during the overrun period shall be determined using the California Statewide Crude Oil Price Index in effect on the first business day of the month within the pay period in which the overrun began.

ADD the following:

- e) This Contract is not subject to the provisions of The WHITEBOOK for Compensation Adjustments for Price Index Fluctuations for the paving asphalt.

SECTION 200 – ROCK MATERIALS

200-1.2 Crushed Rock and Rock Dust. To Table 200-1.2 (A), ADD the following:

Sieve Size	Percent Passing Sieves				
	AASHTO No. 57 ⁽¹⁾	ASTM No. 2 ⁽¹⁾	ASTM No. 8 ⁽¹⁾	ASTM No. 89 ⁽¹⁾	ASTM No. 9 ⁽¹⁾
3 in	-	100	-	-	-
2.5 in	-	90 – 100	-	-	-
2 in	-	35 – 70	-	-	-
1.5 in	100	0 – 15	-	-	-
1 in	95 – 100	-	-	-	-

0.75 in	-	0 – 5	-	-	-
0.5 in	25 – 60	-	100	100	-
0.375 in	-	-	85 – 100	90 – 100	100
No. 4	10 max.	-	10 – 30	20 – 55	85 – 100
No. 8	5 max.	-	0 – 10	5 – 30	10 – 40
No. 16		-	0 – 5	0 – 10	0 – 10
No. 50		-	-	0 – 5	0 – 5

(1) Material shall be washed cleaned and free of fines.

200-1.5.5 Sand Gradations. To Table 200-1.5.5 (A), ADD the following:

Sieve Size	Percent Passing Sieves
	Choker Sand - ASTM C33
0.375 in	100
No. 4	95 – 100
No. 8	80 – 100
No. 16	50 – 85
No. 30	25 – 60
No. 50	5 – 30
No. 100	0 – 10
No. 200	0 – 3

200-1.5.6 Sand For Graded Aggregate Choker Stone. ADD the following:

Sand for graded aggregate choker stone shall be washed and conform to the gradation for Choker Sand ASTM C33 in 200-1.5.5

SECTION 206 - MISCELLANEOUS METAL ITEMS

ADD:

206-3.3.5 Underdrain Cleanout Lid (For Other Areas). Cleanout lids for cleanouts in the road, sidewalk, or any other area where water is not expected to pool shall be Alhambra Foundry A-2302-B cast iron water-tight cover and frame that is rated for traffic applications or approved equal. The cleanout lid shall have a clear opening of 8 inches and have an overall diameter of 13 inches. The frame shall be 1 inch deep. The frame shall be set into the concrete collar and the lid shall seat firmly into the frame without rocking and shall be flush with the surface. Lock screws shall be provided to lock lid to frame. The cleanout lid shall be stamped “SD STORM DRAIN”.

SECTION 207 – PIPE

207-17.2.2 Cell Classification. DELETE in its entirety and SUBSTITUTE with the following:

PVC pipes for storm drains and tertiary treated recycled water (“purple pipe”) that cross existing potable water mains and have a vertical clearance of less than 12” (or more if indicated on the plans) shall have a PVC cell classification of 12454 meeting

AWWA C900, CL200, and meeting the requirements of DR14. No joints are permitted within 4' of the water line crossing.

All other pipes shall be made of PVC Plastic having a cell classification of 12454 or 13364, as defined in ASTM D1784. The fittings shall be made of PVC plastic having a cell classification of 12454 or 13343. PVC compounds of other cell classifications shall be in conformance with 207-17.5. Additives and fillers, including but not limited to stabilizers, antioxidants, lubricants, colorants, etc., shall not exceed 10 parts by weight per 100 of PVC resin in the compound.

207-17.2.3 Pipe Manufacturer. To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

1. PVC products, C900 and C905, as manufactured or distributed by J-M Manufacturing Company or JM Eagle shall not be used on the Contract for pressurized pipe.

ADD:

207-29 PERFORATED PVC PLASTIC PIPE.

207-29.1 General. Perforated PVC Plastic Pipe shall conform to Section 207-17, "PVC Plastic Pipe" of the Standard Specifications.

207-29.2 Materials of Underdrain Pipe. Perforated plastic pipe shall be smooth-wall PVC plastic pipe or corrugated PVC plastic pipe with a smooth interior surface. All pipes shall comply with Section 207-17, "PVC Plastic Pipe" of the Standard Specifications.

207-29.3 Perforation Requirements. The perforation shall be:

Hole Size: 3/8" min.

Center to Center Spacing: 5" max.

Row of Holes: 4 holes per each row, all on the lower half of the pipe. There shall be 2 holes on each side of the centerline of the pipe, 1 hole at 45° from the centerline of pipe and 1 hole at 80° from the centerline of the pipe as indicated on the drawings.

ADD:

207-30 Underdrain Cleanout.

207-30.1 General. All underdrain cleanout PVC Plastic Pipe shall conform to Section 207-17, "PVC Plastic Pipe" of the Standard Specifications. Underdrain cleanouts shall have watertight, vandal-proof caps.

SECTION 211 – MATERIAL TESTS

ADD:

211-6 AGRONOMIC SOILS TEST. The Contractor shall submit an agronomic soil analysis report with recommendations for soil amendments from a licensed laboratory to Resident Engineer at conclusion of rough grading and prior to soil conditioning.

Soil testing shall be paid for by Contractor. A minimum of two soil samples shall be taken from the project site (as directed by the Resident Engineer) and a soil test performed to determine mineral content, permeability, and agricultural suitability. Topsoil to be used shall also be tested. Soil test shall include recommendations for amending or correcting soil conditions. Results of soil analysis shall be received and approved by Resident Engineer prior to amending of soil.

Soil test shall be submitted to an approved and qualified laboratory. Testing methods shall comply with the United States Department of Agriculture Handbook Publication No. 60, Methods of Soil Analysis published by the Soil Science Society of America and peer-viewed methods published in scientific journals. Evaluations and recommendations shall be based on University of California publications and peer-viewed articles published in scientific journals.

The Resident Engineer shall appoint a representative to oversee soil sampling that may be required. The time, depth, location, and number of samples to be taken will be as per instructions from the Resident Engineer. A minimum of three representative samples shall be taken from random and varied locations of the project site that will receive shrub installation or tree planting. Samples shall represent major conditions of exposed cut soils and fill soils. Sample from the top foot for shrub areas and from the expected depth for large container stock. Label each sample for location/origin, type of soil condition visibly observed, and sampling depth. Laboratory report shall identify each sample with the same information. All samples taken shall be split into two samples, one half will be retained by the Resident Engineer. All samples shall be at least one pint in volume. All samples shall go to an approved soil-testing laboratory. Approved soil-testing laboratories are as follows:

Wallace Laboratories

365 Coral Circle
El Segundo, CA 90245
Phone: 310-615-0116
Fax 310-640-6863

Or

Soil & Plant Laboratory

41 East Hunter Ave. Suite A,
Anaheim, CA 92807
Phone: (714) 282-8777
Fax: (714) 282-8575

The Contractor shall provide the Resident Engineer with a copy of the written report by the approved laboratory.

All soil samples shall be analyzed for:

- PH measurement in the saturated extract paste.
- Determination whether limestone is present or not.

- Percent water in saturation extract.
- Electrical conductivity of the saturated extract (salinity ECe)/soluble salts.
- Saturation extract analysis for the major soluble ions: calcium, magnesium, sodium, potassium, chloride, nitrate and sulfate.
- Measurement of sodicity (Sodium Adsorption Ratio).
- Concentration of boron in saturation extract.
- Extractable nutrients and minerals, including potassium, phosphorus, sulfur, magnesium, iron, manganese, zinc, copper, boron, sodium, and molybdenum.
- Problem materials which may be present, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, vanadium.

The extraction methods utilized by the laboratory shall be standard methods. Interpretation of the data shall be given. The laboratory shall also provide an estimate of the soil texture and soil organic matter.

Each soil analysis shall include written recommendations for soils treatments and soils amendments to be added based upon test results. These recommendations shall include:

- Volume of soil amendment per 1,000 sq. ft. of cu. yd. of backfill mix.
- Pounds of gypsum per 1,000 sq. ft. of cu. yd. of backfill mix.
- Pounds of soil sulfur per 1,000 sq. ft. of cu. yd. of backfill mix.
- Pounds of iron sulfate per 1,000 sq. ft. of cu. yd. of backfill mix.
- Pounds of pre-plant fertilizer per 1,000 sq. ft. of cu. yd. of backfill mix and recommended NPK analysis of fertilizer.
- Pounds of soil polymers per 1,000 sq. ft.
- Recommendations for soil leaching
- Recommendation for tree drain installation
- Pounds of maintenance fertilizer per 1,000 sq. ft. and recommended NPK analysis of fertilizer.
- Recommendation for soil wetting agent and application rate.
- Percent of site soil-to-soil amendment in backfill mix.
- Whether or not soil polymers need to be added to soil.

If any of the above listed items are not recommended, the recommendation shall call for zero volume or zero poundage per 1,000 square feet. All soil test costs will be the responsibility of the Contractor.

SECTION 212 - LANDSCAPE AND IRRIGATION MATERIALS

212-1.1.2 Class "A" Topsoil. To the City Supplement, Paragraph 3, between the words "the" and "agricultural", ADD the following:

"gradation limits, permeability rate, and"

Third paragraph, at the end of the test results list, ADD the following:

- m) Measurement of sodicity (Sodium Adsorption Ratio).
- n) Recommendations for soil leaching.
- o) Pounds of pre-plant fertilizer per 1,000 sq. ft. and recommended NPK analysis of fertilizer.
- p) Pounds of maintenance fertilizer per 1,000 sq. ft. and recommended NPK analysis of fertilizer.

212-1.1.3 Class "B" Topsoil. To the City Supplement, Paragraph 1, before the first sentence, ADD the following:

The soil shall be tested for Part 3, agricultural suitability, in accordance with 212-1.1.2, "Class "A" Topsoil." The soils shall be amended in accordance with the recommendations included in the test results and as approved by the Engineer.

212-1.2.5 Mulch. To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

212-1.2.5 Mulch. ADD the following:

"Mulch" shall be bark mulch from one of the following sources: shredded fir or shredded cedar. Rates as specified on plans, free of sticks, stones, clay or other foreign material / or 'Landscape Blend Mulch' available from Agriservice (El Corazon). Phone: 760-643-4071.

Planting areas shall receive minimum three-inch (3") depth.

ADD:

212-1.2.7 Mulch for Hydroseeding. Each package of cellulose shall show air-dry weight. Fiber weight shall be equivalent to ten- percent moisture as based on the Technical Association of Pulp and Paper Industry standards for air-dry cellulose.

Mulch material shall be clean, natural wood cellulose fiber. Natural wood cellulose fiber shall be processed in such a manner that it will contain no growth or germination inhibiting factors and shall be dyed green to facilitate metering of materials. It shall be manufactured in such a manner that after each addition and agitation in slurry tanks with fertilizer, seed, water, and other approved additives, the fibers in the material will become uniformly suspended to form a homogeneous slurry; and that when hydraulically sprayed, will uniformly cover the ground with seed and mulch, and which after application, will allow the absorption of moisture and will allow rainfall to percolate to the underlying soil. Materials which inhibit germination or growth shall not be present in the mixture.

ADD:

212-1.2.3.1 Fertilizer Tablets. Fertilizer tablets shall be tightly compressed, long-lasting, and slow-release with the following minimum guaranteed analysis:

10 gram tablet

Nitrogen	20%
Phosphoric Acid	10%
Potash	5%

212-1.2.6 Inorganic Soil Amendments. To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

Gypsum shall be commercially packaged gypsum with the active ingredient (calcium sulfate) at 95% minimum by volume.

Soil sulfur shall be 98% elemental sulfur.

ADD:

212-1.10 Herbicide. Pre-emergent herbicide shall be as determined by Contractor. The purpose of the pre-emergent herbicide is to control the growth of weeds within planter areas below the bark mulch layer. Contractor shall submit a sample label and Material Safety Data Sheet (MSDS) to the Resident Engineer for approval prior to purchase and applications.

Post-emergent herbicide shall be non-selective type for total control of undesirable vegetation, available as Roundup or approved substitution as determined by the Contractor. Contractor shall submit a sample label and Material Safety Data Sheet (MSDS) to the Resident Engineer for approval prior to purchase and applications. Application shall be in accordance with precautions and rates suggested by the manufacturer.

ADD:

212-2.1.7 Sand Encasement. Sand Encasement for all irrigation pipe, direct burial control wire and electrical conduit shall be clean plaster or mortar sand, as per section 200 of the Greenbook, with a minimum sand equivalent of 50.

ADD:

212-2.2.7 Valve Boxes. To the City Supplement, ADD the following:

3. Valve box locking lids: the Contractor shall rework the locking toggles of the concrete valve boxes by replacing the existing clevis pin and sheet metal clip with a marine-type stainless steel machine bolt and self-locking unit. Apply oil to lubricate and to prevent rust.

ADD:

212-2.2.8.1 Master Control Valve Normally Closed. The normally closed master valve, as noted on the plans, shall be solid brass construction with water-proof 24 VAC 3-way solenoid coil, self-cleaning orifice and one-piece molded construction diaphragm with integral O-ring seal reinforced with 600 lb. test fabric. The valve shall be slow closing to prevent water hammer and surge and shall operate on pressure up to 200 psi for 3/4" though 2" valve sizes and 150 psi for 2-1/2 and 3" valve sizes.

ADD:

212-2.5 Equipment to be Furnished. Contractor shall provide the following to the City prior to final acceptance:

- (a) Five irrigation heads with nozzles (of each type used) for every 100 irrigation heads, or portions thereof, used.
- (b) 2 sets of special tools required for removing, disassembling and adjusting each type of sprinkler and valve supplied on this project.
- (c) 2 five ft. valve keys for operation of gate valves.
- (d) 2 keys for each automatic controller, locking valve boxes and locking quick couplers.
- (e) 2 keys for pump.
- (f) 2 valve keys for ACME and 2 valve keys for potable quick couplers.

ADD:

212-3.2.2.3 Trench Marker Tape. To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

Trench marker tape shall be installed in accordance with Standard Drawing SDM-105, "Warning/Identification Tape Installation".

ADD:

212-3.2.2.4 Wires in Pull Boxes. Wires in Pull Boxes shall be loose and shall not come within 3" from lid. Boxes shall be sized accordingly to accommodate this requirement.

ADD:

212-3.2.2.5 Wire Testing. Wire shall be tested for continuity, open circuits, and unintentional grounds prior to connecting to equipment. Any wiring that is defective shall be replaced, at the Contractor's expense.

ADD:

212-4 BIORETENTION SOIL MEDIA (BSM).

212-4.1 General. Bioretention Soil Media (BSM) is a formulated soil mixture that is intended to filter storm water and support plant growth while minimizing the leaching of chemicals found in the BSM itself. BSM consists of 70% to 85% by volume washed sand and 15% to 30% by volume compost or alternative organic amendment. Alternative proportions may be justified under certain conditions. BSM shall be mixed thoroughly using a mechanical mixing system at the plant site prior to delivery. In order to reduce the potential for leaching of nutrients, the proportion of compost or alternative organic amendment shall be held to a minimum level that will support the proposed vegetation in the system.

212-4.1.1

Sand for Bioretention Soil Media. The sand shall conform to ASTM C33 “fine aggregate concrete sand” requirements. A sieve analysis shall be performed in accordance with ASTM C 136, ASTM D 422, or approved equivalent method to demonstrate compliance with the gradation limits shown in Table 212-4.1.1 (A). The sand shall be thoroughly washed to remove fines, dust, and deleterious materials prior to delivery. Fines passing the No. 200 sieve shall be non-plastic.

Table 212-4.1.1 (A) Sand Gradation Limits

Sieve Size (ASTM D422)	Percent Passing (by weight)	
	Minimum	Maximum
3/8 inch	100	100
#4	95	100
#8	80	100
#16	50	85
#30	25	60
#50	5	30
#100	0	10
#200	0	5

Note: Coefficient of Uniformity (Cu = D60/D10) equal to or greater than 4

212-4.1.2

Compost. Compost shall be certified by the U.S. Composting Council’s Seal of Testing Assurance Program or an approved equivalent program. Compost shall comply with the following requirements:

1. Organic Material Content shall be 35% to 75% by dry weight.
2. Carbon to nitrogen (C:N) ratio shall be between 15:1 and 40:1, preferably above 20:1 to reduce the potential for nitrogen leaching/washout.
3. Physical contaminants (manmade inert materials) shall not exceed 1% by dry weight.
4. pH shall be between 6.0 and 7.5.
5. Soluble Salt Concentration shall be less than 10 dS/m (Method TMECC 4.10-A, USDA and U.S. Composting Council).
6. Maturity (seed emergence and seedling vigor) shall be greater than 80% relative to positive control (Method TMECC 5.05-A, USDA and U.S. Composting Council)

7. Stability (Carbon Dioxide evolution rate) shall be less than 2.5 mg CO₂-C per g compost organic matter (OM) per day or less than 5 mg CO₂-C per g compost carbon per day, whichever unit is reported. (Method TMECC 5.08-B, USDA and U.S. Composting Council). Alternatively a Solvita rating of 6 or higher is acceptable.
8. Moisture shall be 25%-55% wet weight basis.
9. Select Pathogens shall pass US EPA Class A standard, 40 CFR Section 503.32(a).
10. Trace Metals shall pass US EPA Class A standard, 40 CFR Section 503.13, Tables 1 and 3.
11. Shall be within gradation limits in Table 800-4.1.2 (ASTM D 422 sieve analysis or approved equivalent).

Table 212-4.1.2 Compost Gradation Limits

Sieve Size	Percent Passing (by weight)
16 mm (5/8")	99 to 100
6.3 mm (1/4")	40 to 95
2 mm	40 to 90

212-4.1.3 Alternative Mix Components and Proportions. Alternative mix components and proportions may be utilized, provided that the whole blended mix (212-4.2) conforms to agricultural, chemical, and hydraulic suitability criteria, as applicable. Alternative mix designs may include alternative proportions, alternative organic amendments and/or the use of natural soils. Alternative mixes are subject to approval by the City Engineer.

212-4.2 Whole BSM Testing Requirements and Criteria. You shall submit the following information to the City Engineer at least 30 Days prior to ordering materials:

1. Source/supplier of BSM,
2. Location of source/supplier,
3. A physical sample,
4. Available supplier testing information,
5. Whole BSM test results from a third party independent laboratory,
6. Description of proposed methods and schedule for mixing, delivery, and placement of BSM.

Test results shall be no older than 120 Days and shall accurately represent the materials and feed stocks that are currently available from the supplier.

Test results shall demonstrate conformance to agricultural suitability criteria (212-4.2.1), chemical suitability criteria (212-4.2.2), and hydraulic suitability criteria (212-4.2.3). No delivery, placement, or planting of BSM shall begin until test results confirm the suitability of the BSM. You shall submit a written request for approval which shall be accompanied by written analysis results from a written report of a testing agency. The testing agency shall be registered by the State for agricultural soil evaluation which indicates compliance stating that the tested material proposed source complies with these specifications.

212-4.2.1

BSM Agricultural Suitability. The BSM shall be suitable to sustain the growth of the plants specified and shall conform to the following requirements:

- a) pH shall be between 6.0-7.5.
- b) Salinity shall be less than 3.0 millimho/cm (as measured by electrical conductivity).
- c) Sodium adsorption ration (SAR) shall be less than 3.0.
- d) Chloride shall be less than 150 ppm.

The test results shall show the following information:

- a) Date of testing
- b) Project name
- c) The Contractor's name
- d) Source of materials and supplier's name
- e) pH
- f) E_c
- g) Total and plant available elements (mg/kg particle concentration): phosphorus, potassium, iron, manganese, zinc, copper, boron, calcium, magnesium, sodium, sulfur, molybdenum, nickel, aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, mercury, selenium, silver, strontium, tin, and vanadium. Plant available concentration shall be assessed based on weak acid extraction(ammonium Bicarbonate/DTPA soil analysis or similar)
- h) Soil adsorption ratio
- i) Carbon/nitrogen ratio
- j) Cation exchange capacity
- k) Moisture content
- l) Organic content
- m) An assessment of agricultural suitability based on test results
- n) Recommendations for adding amendments, chemical corrections, or both.

BSM which requires amending to comply with these specifications shall be uniformly blended and tested in its blended state prior to testing and delivery

212-4.2.2

BSM Chemical Suitability. For systems with underdrains, the BSM shall exhibit limited potential for leaching of pollutants that are at levels of concern. Potential for pollutant leaching shall be assessed using either the Saturated Media Extract Method (aka, Saturation Extract) that is commonly performed by agricultural laboratories or the Synthetic Precipitation Leaching Procedure (SPLP) (EPA SW-846, Method 1312). The referenced tests express the criteria in terms of the pollutant concentration in water that is in contact with the media. In areas in which a pollutant or pollutants are associated with a water quality impairment or a TMDL, BSM in systems with underdrains shall conform to the following Saturation Extract or SPLP criteria for applicable pollutant(s):

1. Nitrate < 3 mg/L
2. Phosphorus < 1 mg/L*
3. Zinc < 0.1 mg/L
4. Copper < 0.025 mg/L
5. Lead < 0.025 mg/L
6. Arsenic < 0.02 mg/L
7. Cadmium < 0.01 mg/L
8. Mercury < 0.01 mg/L
9. Selenium < 0.01 mg/L

Criteria shall be met as stated where a pollutant is associated with a water quality impairment or Total Maximum Daily Load (TMDL) in any downstream receiving water. Criteria may be waived or modified, at the discretion of the City Engineer, where a pollutant does not have a nexus to a water quality impairment or TMDL of downstream receiving water(s). Criteria may also be modified at the discretion of the City Engineer if the you demonstrate that suitable BSM materials cannot be feasibly sourced within a 50 mile radius of the project site and a good faith effort has been undertaken to investigate available materials.

Note that Saturation Extract and SPLP tests are expected to result in somewhat more leaching than would be experienced with real stormwater; therefore a direct comparison to water quality standards or effluent limitations is not relevant.

212-4.2.3

BSM Hydraulic Suitability.

1. The saturated hydraulic conductivity or infiltration rate of the whole BSM shall be measured by one of the following methods:
 - a. Measurement of hydraulic conductivity (USDA Handbook 60, method 34b) (commonly available as part of standard agronomic soil evaluation), or
 - b. ASTM D2434 Permeability of Granular Soils (at approximately 85% relative compaction Standard Proctor, ASTM D698)

212-4.3

Delivery, Storage and Handling. You shall not deliver or place soils in frozen, wet, or muddy conditions. You shall protect soils and mixes from absorbing excess water and from erosion at all times. You shall not store materials unprotected during large rainfall events (>0.25 inches). If water is introduced into the material while it is stockpiled, you shall allow the material to drain to the acceptance of the City Engineer before placement.

BSM shall be thoroughly mixed prior to delivery using mechanical mixing methods such as a drum mixer. BSM shall be lightly compacted and placed in loose lifts approximately 12 inches (300 mm) to ensure reasonable settlement without excessive compaction. Compaction within the BSM area shall not exceed 75 to 85% standard proctor within the designed depth of the BSM. Machinery shall not be used in the bioretention facility to place the BSM. A conveyor or spray system shall be used for media placement in large facilities. Low ground pressure equipment may be authorized for large facilities at the discretion of the City Engineer.

Placement methods and BSM quantities shall account for approximately 10% loss of volume due to settling. Planting methods and timing shall account for settling of media without exposing plant root systems.

The Engineer may request up to three double ring infiltrometer tests (ASTM D3385) or approved alternative tests to confirm that the placed material meets applicable hydraulic suitability criteria (212-4.2.3). In the event that the infiltration rate of placed material does not meet applicable criteria, the City Engineer may require replacement and/or decompaction of materials.

212-4.4

Quality Control and Acceptance. Close adherence to the material quality controls herein are necessary in order to support healthy vegetation, minimize pollutant leaching, and assure sufficient permeability to infiltrate/filter runoff during the life of the facility. Amendments may be included to adjust agronomic properties. Acceptance of the material will be based on test results certified to be representative. Test results shall be conducted no more than 120 Days prior to delivery of the blended BSM to the project site. For projects installing more than 100 cubic yards of BSM, batch-specific tests of the blended mix shall be provided to the City Engineer for every 100 cubic yards of BSM along with a site plan showing the placement locations of each BSM batch within the facility.

212-4.5

Integration with Other Specifications. This specification includes, is related to, and may depend or have dependency on other specifications, including but not limited to:

- Plantings and Hydroseed
- Mulch
- Aggregate (choking stone, drainage stone, energy dissipation)
- Geotextiles
- Underdrains
- Outlet control structures
- Excavation

Execution of this specification requires review and understanding of related specifications. Where conflicts with other specifications exist or appear to exist, you shall consult with the City Engineer to determine which specifications prevail.

SECTION 213 – ENGINEERING FABRICS

ADD:

213-3 PLASTIC LINER.

213-3.1 General. This section applies to all areas that receive a plastic liner to provide an impermeable barrier to prevent water or other liquids from infiltrating into the subgrade. This section also applies for the material required to provide a seal at each utility penetration through the plastic liner that is associated with water service, gas service, sewer lateral and underdrain crossings.

213-3.2 Submittal. The Contractor shall submit a Manufacturer's Certificate in accordance with 2-5.3 that the material complies with this specification.

213-3.3 Materials.

213-3.3.1 Flexible Plastic Liner. PVC liners used for the lining of green infrastructure shall meet the requirements of ASTM D-7176, Standard Specification for PVC geomembranes used in buried applications and shall conform to the requirements in Table 213-3.3.1 (A). The PVC liner shall be ultraviolet light resistant and shall be sufficiently flexible to cover and closely conform to all edges and corners of the filter bed excavation at ambient temperatures as low as 45 degrees Fahrenheit without application of heat. A geotextile fabric shall be placed on the top and bottom of the membrane for puncture protection. The geotextile fabric shall be nonwoven geotextile fabric meeting the requirements indicated in Table 213-2.2 (A).

SECTION 300 – EARTHWORK

300-1.4 Payment. To the City Supplement, paragraph (2), DELETE in its entirety and SUBSTITUTE with the following:

2. Payment for existing pavement removal and disposal of up to 12" thick, within the excavation e.g., trench limits, shall be included in the Bid item for installation of the mains or the Work item that requires pavement removal.

ADD:

300-2.1.1 Miscellaneous Grading Conditions.

Site Grading. Slope grades to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: Plus or minus 1 inch.
2. Walks: Plus or minus 1 inch.
3. Pavements: Plus or minus 1/2 inch.

Moisture Control. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill material on surfaces that are muddy.
2. Remove and replace, or scarify and air-dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

Compaction of Backfill and Fills.

1. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
2. Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
3. Compact soil to not less than the following percentages of maximum density of 90% compaction according to ASTM D 1557:

Under structures and building slabs scarify and recompact to a depth of forty two inches per the geotechnical report.

Under all other pavement, subgrade shall be scarified and recompacted to a depth of twelve inches per the geotechnical report, unless indicated otherwise.

Slope Repair Grading. Site runoff shall not be permitted to flow over the tops of slopes. Positive drainage shall be established away from the top of slopes:

1. Permanent cut and fill slopes shall not be steeper than 2:1 (horizontal:vertical)
2. Compaction of the face of fill slopes shall be performed by backrolling at intervals of 4 feet or less in vertical slope height, or as dictated by the capability of the available equipment, whichever is less. Fill slopes shall be backrolled utilizing a conventional sheepsfoot –type roller.

SECTION 301 – TREATED SOIL, SUBGRADE PREPARATION, AND PLACEMENT OF BASE MATERIALS

ADD:

301-6 GRADED AGGREGATE CHOKER STONE.

301-6.1 General. Graded aggregate choker stone is installed to separate the bioretention soil media from the drainage rock reservoir layer to ensure that no migration of sand or other fines occurs. The graded aggregate choker stone consists of two layers of media increasing in size. The top layer of the graded aggregate choker stone shall be constructed of sand material conforming to 200-1.5.6 The bottom layer of the graded aggregate choker stone shall be constructed of aggregate material conforming to 200-1 Table 200-1.2 (A) ASTM No. 8.

301-6.2 Spreading. Imported graded aggregate choker stone shall be delivered to the roadbed as uniform mixtures and each layer shall be spread in one operation. Segregation within each aggregate layer shall be avoided and the layers shall be free from pockets of coarse or fine material.

Aggregate shall be deposited on the drainage stone at a uniform quantity per linear foot (meter), which quantity will provide the required compacted thickness within the tolerances specified herein without resorting to spotting, picking up, or otherwise shifting the aggregate material.

The bottom layer of the graded aggregate choking stone (ASTM No.8) shall be installed to a thickness of 2 inches (50 mm). The layer shall be spread in one layer. The top layer of the graded aggregate choking stone (ASTM C33) shall be installed to a thickness of 2 inches (50 mm). The layer shall be spread in one layer.

301-6.3 Compacting. Rolling shall always commence along the edge of the area to be compacted and the roller shall gradually advance toward the center of the area to be compacted. Vibratory compaction is not permitted.

The minimum relative compaction of the aggregate choker stone shall be 90 percent.

301-6.4 Measurement and Payment. Quantities of graded aggregate choker stone will be measured as shown in the Bid. The volumetric quantities of graded aggregate choker stone material shall be those placed within the limits of the dimensions shown on the Plans. The weight of material to be paid for will be determined by deducting (from the weight of material delivered to the Work) the weight of water in the material (at the time of weighing) in excess of 1 percent more than the optimum moisture content. No payment will be made for the weight of water deducted as provided in this subsection.

SECTION 302 – ROADWAY SURFACING

302-3 PREPARATORY REPAIR WORK. To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

302-3 PREPARATORY REPAIR WORK.

1. Prior to roadway resurfacing or the application of slurry, the Contractor shall complete all necessary preparation and repair work to the road segment e.g., tree trimming, weed spray, weed abatement, crack sealing, asphalt repair, hump removal, miscellaneous asphalt patching, removal of raised pavement markers, removal of pavement markings, etc. and as specified in the Special Provisions.
2. Preparatory work shall include, but not be limited to, tree trimming, weed spray, weed abatement, crack sealing, asphalt repair i.e., mill and pave, hump removal, miscellaneous asphalt patching, removal of raised pavement markers, removal of pavement markings, etc.
3. The Contractor shall repair areas of distressed asphalt concrete pavement by milling or removing damaged areas of pavement to a minimum depth of 2” for Residential streets, and a minimum depth of 3” for all others to expose firm

and unyielding pavement. The Contractor shall prepare subgrade as needed and install a minimum of 2” for residential streets, and a minimum of 3” for all others, of compacted asphalt concrete pavement over compacted native material as directed by the Engineer.

4. If, in order to achieve the minimum specified depth, the base material is exposed, the material shall be compacted to 95% relative compaction to a depth 10” below the finished grade (dig out). Compaction tests shall be made to ensure compliance with the specifications. The Engineer will determine when and where the test will occur. The City will pay for the soils testing required by the Engineer, which meets the required compaction. The Contractor shall reimburse the City for the cost of retesting failing compaction tests. If additional base material is required, the Contractor shall use Class 2 Aggregate Base in accordance with 200-2.2, “Crushed Aggregate Base.”
5. Recycled base material shall conform to Crushed Miscellaneous Base Material in accordance with 200-2.4, “Crushed Miscellaneous Aggregate Base.”
6. Prior to replacing asphalt, the area shall be cleaned by removing all loose and damaged material, moisture, dirt, and other foreign matter and shall be tack coated in accordance with 302-5.4 “Tack Coat.”
7. The Contractor shall install new asphalt within the repair area or for patches in accordance with 302-5, “ASPHALT CONCRETE PAVEMENT.” Asphalt concrete shall be C2-PG 64-10 in compliance with 400-4, “ASPHALT CONCRETE.”
8. No preparatory asphalt work shall be done when the atmospheric temperature is below 50 °F or during unsuitable weather.
9. Following the asphalt placement, the Contractor shall roll the entire area of new asphalt in both directions at least twice. The finished patch shall be level and smooth in compliance with 302-5.6.2 “Density and Smoothness.” After placement and compaction of the asphalt patch, the Contractor shall seal all finished edges with a 4” wide continuous band of SS-1H.
10. The minimum dimension for each individual repair shall be 4’ x 4’ and shall be subject to the following conditions:
 - a) If the base material is exposed to achieve the required minimum removal thickness, the base material shall be prepared conforming to 301-1, “SUBGRADE PREPARATION.”
 - b) When additional base material is required, then the contractor shall use Class 2 Aggregate Base in accordance with 200-2.2, “Crushed Aggregate Base.” Recycled base material shall conform to Crushed Miscellaneous Base Material in accordance with 200-2.4, “Crushed Miscellaneous Base.”
 - c) The Contractor may use grinding as a method for removal of deteriorated pavement when the areas indicated for removal are large enough (a minimum of the machine drum width) and when approved by the Engineer.

- d) For both scheduled and unscheduled base repairs, failed areas may be removed by milling or by excavation provided that the edges are cut cleanly with a saw. The areas shall be cleaned and tack coated in accordance with 302-5.4, "Tack Coat" before replacing the asphalt. The areas for scheduled repairs have been marked on the street.

302-3.1 Asphalt Patching.

1. Asphalt patching shall consist of patching potholes, gutter-line erosion, and other low spots in the pavement that are deeper than ½" per 302-5.6.2, "Density and Smoothness." These areas are generally smaller and more isolated than those areas in need of mill and pave.
2. The areas requiring patching have been identified in the Contract Documents, marked on the streets, or as directed by the Engineer. The Contractor shall identify any new areas that may require patching prior to slurry work to ensure the smoothness and quality of the finished product.
3. The Contractor shall identify and repair any areas that may require patching, prior to the placement of slurry seal for smooth finished product.
4. Asphalt overlay shall not be applied over deteriorated pavement. Preparatory asphalt work shall be completed and approved by the Engineer before proceeding with asphalt overlay.
5. The Contractor shall remove distressed asphalt pavement either by saw cutting or milling, to expose firm and unyielding pavement; prepare subgrade (as needed); and install compacted asphalt concrete pavement over compacted native material as directed by the Engineer.
6. Prior to replacing asphalt, the area shall be cleaned and tack coated per 302-5.4, "Tack Coat".
7. Following the asphalt placement, the Contractor shall roll the entire patch in both directions covering the patch at least twice.
8. After placement and compaction of the asphalt patch, the Contractor shall seal all finished edges with a 4" wide continuous band of SS-1H.
9. Base repairs shall not exceed 20% RAP in content.

302-3.2 Payment.

1. Payment for replacement of existing pavement when required shall be included in the unit bid price for Asphalt Pavement repair for the total area replaced and no additional payment shall be made regardless of the number of replacements completed. No payment shall be made for areas of over excavation or outside trench areas in utility works unless previously approved by the Engineer. No payment for pavement replacement will be made when the damage is due to the Contractor's failure to protect existing improvements. The Contractor shall reimburse the City for the cost of retesting all failing compaction tests.

2. The areas and quantities shown on the road segments and in appendices are given only for the Contractor's aid in planning the Work and preparing Bids. The Engineer will designate the limits to be removed and these designated areas shall be considered to take precedent over the area shown in an Appendix to the Contract Documents. The quantities shown in the appendices are based on a street assessment survey and may vary.
3. At the end of each day, the Contractor shall submit to the Engineer an itemized list of the asphalt pavement repair work completed. The list shall include the location of the work and the exact square footage of the repair.
4. Preparatory repair work and tack coating will be paid at the Contract unit price per ton for Asphalt Pavement Repair. No payment shall be made for areas of over excavation unless previously approved by the Engineer.
5. Milling shall be included in the Bid item for Asphalt Pavement Repair unless separate Bid item has been provided.
6. Payment for miscellaneous asphalt patching shall be included in the Contract unit price for slurry and no additional payment shall be made therefore.

302-5.1.1 Damaged AC Pavement Replacement. To the City Supplement, DELETE in its entirety.

302-5.1.2 Measurement and Payment. To the City Supplement, DELETE in its entirety.

302-5.2.1 Measurement and Payment. To the City Supplement, item c), ADD the following:
Imported Subgrade material shall be paid per bid item "Imported Backfill".

ADD:

302-15 DISINTEGRATED GRANITE PAVEMENT.

302-15.1 General. Disintegrated Granite Pavements shall conform to 200-2.7.

302-15.2 Samples and Submittals.

1. Sieve analysis of aggregates
2. Aggregate color

302-15.3 Preparation of Sub Base.

1. Base shall be a compacted layer of Class II base as defined on the plans or existing overexcavated and recompacted engineered fill.
2. Pre-soak base material and compact to 95% prior to installing stabilized aggregate material.

302-15.4 Blending. Stabilizer shall be thoroughly pre-mixed with crushed stone/sand (DG) mixed at the rate of 15lbs of stabilizer per 1 ton of aggregate. Stabilizer shall be

mechanically pre-mixed per the manufacturer's recommendations using an approved mechanical blending unit that will adequately mix and blend the stabilizer with the aggregate. Always blend the materials dry. (Bucket blending and drop spreading over in-place aggregate or mixing by rototilling are not acceptable methods of blending).

302-15.5 Placement. Place the aggregate and stabilizer mixture on a prepared base and rake smooth to a desired grade and cross section. Place material in lifts of no more than 2.5" thick to achieve desired thickness.

302-15.6 Watering. Water heavily for full depth moisture penetration of the stabilized profile at the rate of 25-45 gallons of water per ton of aggregate. During water application test moisture using a probing device reaching full depth.

302-15.7 Compaction.

1. Compact with a roller within 6-48 hours. Compaction should not occur if separation, plowing or other physical compromise of aggregate is encountered.
2. Lightly sprinkle surface to prevent from drying out.
3. Compact material with a compactor/roller making 3 to 4 passes (do not use a vibratory unit). Upon thorough moisture penetration, compact aggregate to 85% relative compaction using a 1-5 ton double drum roller or a 1,000 lb single drum roller.
4. Water the surface area with a light spray following compaction. Contractor shall take care as to not disturb the aggregate surface with the spray action.

302-15.8 Measurement. Stabilized Disintegrated Granite will be measured by the square ft.

302-15.9 Payment. Payment for Stabilized Disintegrated Granite shall include full compensation for sub base, concrete curbs, binder, etc. required to complete the work shown on the plans or in the specifications. It shall be included in the lump sum bid item for the construction of the park.

SECTION 306 – UNDERGROUND CONDUIT CONSTRUCTION

306-10 UNDERDRAINS.

306-10.1 General. Trenches for underdrains where perforated PVC pipes are located shall be excavated, the plastic liner placed per 306-23, the pipe installed and the trench backfilled with permeable material according to the dimensions and details shown on the plans. When underdrains are installed in trenches outside the subgrade area, the top 6" (150 mm) of the trench shall be backfilled, as shown on the plans, with structure backfill conforming to Section 300-3, "Structure Excavation and Backfill".

The underdrain system shall be located above the invert of adjacent storm water systems.

To prevent clogging of underdrain from construction sediments, the associated stormwater facilities shall be excavated to rough grade. After the contributing drainage area is stabilized, the underdrains and the stormwater facilities shall be constructed to achieve the final elevation.

306-10.2 Installation. The solid and perforated PVC pipe shall be installed per Section 306-1.2. The perforated PVC pipe shall be placed such that the perforations are pointed downward. The drainage stone shall be placed and compacted so that it is firm and unyielding prior to placing the pipe. Subsequent backfill shall be in lifts no greater than 8" and compacted to be firm and unyielding. The underdrain shall be encased in a layer of clean, double washed ASTM D448 No.57 or smaller (No. 68, 8, or 89) stone.

306-10.3 Jointing. Jointing of solid PVC pipe shall be securely made in accordance with Section 306-1.2.10. Where there is less than 12" of vertical clearance between the underdrain and the existing water line (or more if indicated on the plans), then no joints be within 4' of either side of the existing water line.

Perforated PVC pipe shall be connected with belled ends, or with sleeve-type or stop-type couplings under AASHTO M 278. Solvent cementing of joints is required.

306-10.4 Payment. Underdrains are measured along the longitudinal axis between the ends as laid and shall include the actual pipe in place and shall not include the inside dimensions of junction structures. The payment quantity includes the length of elbows, outlets, risers, tees, wyes and other branches to the point of intersection. It shall be included in the lump sum bid item for the construction of the park and shall be considered full compensation for all materials, labor, tools, equipment and incidentals (including pipe risers, caps, and fittings) and all other work (excluding any soil removal taken into account in the bid item for excavation) to install the underdrain, complete in place.

ADD:

306-11 UNDERDRAIN CLEANOUTS.

306-11.1 General. Underdrain cleanout structures shall include in-line wye fittings and stub for access where called for in the plans.

306-11.2 Installation. The wells/cleanouts shall be connected to the perforated underdrain with the appropriate manufactured connections. The wells/cleanouts shall be capped with a lockable screw cap. The ends of underdrain pipes not terminating in an observation well/cleanout shall also be capped.

306-11.3 Acceptance.

306-11.3.1 General. When construction is complete, the contractor shall test all completed underdrain systems for continuous, unimpeded flow.

306-11.3.2 Test Methods. After backfill and installation is complete, the suggested test methods for each pipe run are as follows:

1. At highpoint or upstream end of underdrain pipe, open cleanout and insert hose from water source.
2. Turn on water
3. Acceptance of pipe run consists of free flow of water through drain outlet into the existing storm drain structure.

Any sections of the underdrain that are clogged or crushed shall be replaced at the contractor's expense per the plans and specifications.

- 306-11.4** **Payment.** Payment for underdrain cleanouts shall be made at the Lump Sum price in the Bid for the construction of the park and shall be full payment for each structure complete in place, including shoring, backfill, compaction, installation of cleanout including wye and jointing, pipe riser, gaskets, frame and cover or screw cap, concrete encasement, and all other labor, materials, tools, equipment and incidentals needed to complete the work.

SECTION 308 – LANDSCAPE AND IRRIGATION INSTALLATION

308-2 EARTHWORK AND TOPSOIL PLACEMENT.

308-2.1 General. ADD the following:

Moisture Content: Do not perform soil preparation and earthwork if soil moisture content is such that excessive soil compaction will result. Apply water to control dust, break up soil clods, and provide suitable moisture content for tilling and planting.

308-2.2 Trench Excavation and Backfill. To the last paragraph, DELETE in its entirety and SUBSTITUTE with the following:

Trenches shall not be backfilled, except to anchor pipe, until required tests are completed and accepted by the City. Pipe joints shall remain exposed until satisfactory completion of testing. Lateral trenches, and mainline trenches after initial sand backfill, shall be carefully backfilled with approved fine select material, consisting of loam, sandy clay, sand, and other approved materials-free from large clods of earth and stones. Backfill shall be mechanically compacted in landscaped areas to dry density equal to adjacent undisturbed soil in planting areas. Backfill shall conform to adjacent grades without settlement, sunken areas, humps, and other surface irregularities.

Flooding of trenches will be permitted only with approval of the City, in accordance with subsection 306-1.3.3.

If trench settlement occurs and subsequent adjustments in pipe, valves, sprinkler heads, drip emitters, planting, and other installations are necessary, then Contractor shall make required adjustments at no extra cost to the City.

ADD:

308-2.2.1 Trenching and Backfilling Under Paving. PVC Schedule 40 sleeves shall be placed for irrigation pipe installed below paving.

Trenches located below paving (asphaltic concrete and concrete) shall be backfilled with sand (six inches above and below the pipe). Compact backfill in layers to 95% relative density (minimum) with manual or mechanical tamping devices.

Trenches shall be flush with adjoining subgrade. Contractor shall set in place, cap and pressure test piping under pavement prior to start of paving work.

Install piping under existing walks by jacking or boring. If cutting or breaking of sidewalks is necessary, then Contractor shall replace concrete walks at no extra cost to the City. Permission to cut or break sidewalks shall be obtained from the Resident Engineer. No hydraulic boring shall be permitted under concrete paving.

308-2.3.1 General. After the second paragraph, ADD the following:

Grading and soil preparation work shall be performed only during periods when beneficial and optimum results may be obtained. If soil moisture content reaches a level so that working it would destroy soil structure, then soil preparation and grading operations shall be suspended. Resume work when soil moisture content is increased or reduced to acceptable levels and desired results of soil conditioning are likely to be obtained.

Remove fourth paragraph.

ADD the following:

Soil preparation for plant pits for trees shall be imported amended class 'A' topsoil per the planting notes.

Soil preparation for shrub areas and slopes shall be class 'A' topsoil. Remove cobble over 4" in size from plant pits only, stockpile cobbles for use in other parts of the project.

Finish grading shall include removal of all cobble over 1/2" from the surface. Stockpile cobble on site for re-use in other parts of the project.

308-2.3.2 Fertilizing and Conditioning Procedures. To the second paragraph, ADD the following:

Prior to beginning work of this section, Contractor shall submit to the Resident Engineer a written list of adjusted soil amendments, quantities and methods of application as recommended by Contractor-provided agronomic soil analysis report (Section 211-6, Agronomic Soils Tests).

Amendments are provided on plans for bidding purposes only. Actual types and quantities shall be based upon soil analysis provided by Contractor.

ADD after the last paragraph:

Weed Control: Upon completion of the irrigation system and after existing weeds and growth have been removed from planting areas, weed abatement program shall begin. The weed abatement period may be waived or reduced with Engineer's written approval.

ADD:

308-2.5 Bioretention Soil Media.

308-2.5.1 Spreading. Imported BSM drainage material shall be delivered to the BMP system installation site as uniform mixtures and each layer shall be spread in one operation. Segregation within each aggregate layer shall be avoided and the layers shall be free from pockets of coarse or fine material.

Aggregate shall be deposited on underlying layers at a uniform quantity per linear foot (meter), which quantity will provide the required compacted thickness within the tolerances specified herein without resorting to spotting, picking up, or otherwise shifting the aggregate material.

The thickness of the aggregate storage layer (AASHTO No. 57) will depend on site specific design and shall be detailed in contract documents.

The bottom layer of the filter course (ASTM No.8) shall be installed to a thickness of 3 inches (75 mm). The layer shall be spread in one layer. The top layer of the filter course (ASTM C33) shall be installed to a thickness of 3 inches (75 mm). The layer shall be spread in one layer. Marker stakes should be used to ensure uniform lift thickness

308-2.5.2 Compacting. Filter course material and aggregate storage material shall be lightly compacted to approximately 80% standard proctor without the use of vibratory compaction.

308-4.1 General. DELETE in its entirety and SUBSTITUTE with the following:

- 1) Irrigation work shall be inspected and accepted prior to start of work of this Section.
- 2) Plant material quantities, species, and sizes shall be provided as shown on Plans. Plants shall be inspected and accepted by the City before removal from containers and excavating soil for planting holes.
- 3) Planting areas shall be irrigated to a minimum depth of six inches prior to planting installation. Planting pits shall be filled and water allowed to percolate a minimum of three times prior to planting installation. If water is not completely absorbed within 24 hours during any of the three percolation tests, contact the Resident Engineer for further instruction prior to planting.
- 4) Plant quantities on Plans are for Contractor's convenience only. Symbols shall take precedence over written numeric quantities.
- 5) Scarify sides of plant root balls with sharp tool to depth of one inch to girdle circular root growth prior to planting.
- 6) Planting shall be performed with materials, equipment, and procedures most favorable to establishment and growth of plants.
- 7) Containers shall be opened and removed so that plant root balls are not injured.

308-4.3 Layout and Plant Location. ADD the following:

If underground construction work and obstructions are encountered during the planting operations, alternate locations for plant material will be selected by the City. Plant relocation shall be performed at no extra cost to the City.

308-4.4 Specimen Planting. Before the first paragraph, ADD the following:

Planting pits for trees 24-inch box size and larger shall be excavated at least 12 inches larger than the original plant container. Scarify soil at sides and bottom of planting pit.

308-4.6.1 Method A Tree Staking. DELETE in its entirety and SUBSTITUTE with the following:

24-inch box size trees, shall be staked in accordance with planting details.

308-4.6.3 Guying. ADD the following:

36-inch box size trees and larger shall be guyed.

308 - 4.8.1 General. ADD the following:

All fine grading shall be completed and approved in a manner satisfactory to the Engineer.

In addition to any other certificates specified, the Contractor shall furnish a certificate with delivery of seed material stating the source; quantity; type of material; and that the material conforms to the specification requirement. A copy of this certificate shall be submitted to the Engineer prior to the start of the maintenance period.

Provide notification of the delivery schedule in advance so material may be inspected upon arrival at the job site. Remove unacceptable material from the job site immediately. Protect seed during delivery to prevent damage.

Hydroseeding shall not be done when the ground is muddy or in an unsatisfactory condition for planting.

308-4.8.2 Seed. To subsection "b", "Method B.", ADD the following:

STEP ONE:

1. Apply stolons at a rate of 80 bushels/acre with wood pulp.
2. "Wood pulp" shall be per materials section or approved equal, at a rate of 500 lbs./acre. Include granular fertilizer at a rate specified by the soils report.
3. Equipment and Application: Hydraulic equipment used for the application of slurry shall have a built in agitation system with an operating capacity sufficient to agitate, suspend and homogeneously mix the above slurry. Distribution lines shall be large enough to prevent stoppage and to provide even distribution of the slurry over the ground. The pump shall be capable of exerting at least 150 psi at the nozzle or sufficient additional pressure for proper coverage. The slurry tank shall have a minimum capacity of 1,500 gallons and shall be mounted on a traveling unit which will place the slurry tank and spray nozzles within sufficient proximity to the areas to be seeded so as to provide uniform distribution without waste and shall be thoroughly clean and free of seed species that are not specified.
4. Application: The operator shall spray the surfaces with a uniform, visible coat by using the green color of the wood pulp as a guide. The slurry shall be applied in a sweeping motion, in an arched stream allowing the wood fibers to build on each other until a good coat is achieved and the material is spread.

5. Time Limit: All slurry mixture which has not been applied to the surfaces within two hours after mixing will be rejected and removed from the project at the Contractor's expense.

STEP TWO:

1. Wood pulp and tackifier shall be applied together at the following rates: wood pulp at a rate of 1500 lbs./acre, tackifier at a rate of 120 lbs./acre.
2. Equipment and application: repeat processes "3 and 4" above.

"Tackifier" shall be m-binder from Stover Seed or approved equal, at a rate of 120 lbs./acre.

Note that the above mixture is to be used as the basis for bids – the final mixture to be used shall conform to recommendations made by the Engineer based upon the soils report furnished by the Contractor.

Special care is to be exercised by the Contractor to prevent the slurry from being sprayed onto any adjacent property, or onto drainage ditches and cobble boiwales. Any slurry sprayed onto these areas should be cleaned off by the Contractor.

All hydroseeding is subject to approval by the Engineer or his representative, and they shall, if necessary, be adjusted or relocated as directed, as part of the contract. The Engineer may make inspections during seeding. Seed that has not been handled or applied properly shall be subject to re-application, if required by the Engineer.

ADD:

308-4.10 Mulching. Spread mulch uniformly in planting areas as indicated on Plans, to a minimum depth of two inches.

308-5.1 General. Between second and third paragraph, ADD the following:

Existing Trees: If excavating adjacent to existing trees, Contractor shall exercise caution to avoid injury to trees and tree roots. Excavation near roots 1-1/2 inches and larger shall be done by hand. Tunnel under roots 1-1/2 inches and larger in diameter, except directly in the path of pipe and conduit. Roots shall be heavily wrapped with burlap to prevent scarring and excessive drying. If a trenching machine is run close to trees with roots smaller than 1-1/2 inches in diameter, wall of the trench adjacent to tree shall be hand trimmed, making clean cuts through roots. Trenches adjacent to trees should be closed within twenty-four hours; if not possible, side of the trench adjacent to the tree shall be kept shaded with burlap or canvas.

308-5.6.3 Sprinkler Coverage Test. ADD the following:

After completion of irrigation system, and prior to planting, Contractor shall perform a coverage test in the presence of the City to determine whether coverage is complete and adequate. Contractor shall correct inadequate sprinkler coverage.

Adjustment of the System: Contractor shall flush and adjust sprinkler heads for optimum performance and to prevent overspray onto walks, roadways, and buildings.

If adjustments to irrigation equipment will provide better coverage and operation, then Contractor shall make such adjustments prior to planting. Adjustments may include changes in sprinkler nozzle sizes and degrees of arc. Adjustments to irrigation system equipment shall be made at no extra cost to the City.

Lowering raised sprinkler heads by the Contractor shall be accomplished within ten (10) days after notification by the City.

Sprinkler heads shall be set perpendicular to finished grades unless otherwise designated on the plans.

308-5.6.4 Operational Test. ADD the following:

Prior to final acceptance, the irrigation system shall be inspected by the City, and deficiencies shall be corrected by the Contractor. The entire irrigation system shall be under full automatic operation for a period of seven (7) days prior to planting work. The City reserves the right to waive or shorten the operation period.

308-6 MAINTENANCE AND PLANT ESTABLISHMENT. After Paragraph Two, ADD the following:

Contractor shall furnish sufficient supervisory and working personnel capable of accomplishing work required under this Section on schedule and in accordance with Contract Documents. Maintenance personnel shall conduct themselves in a proper and efficient manner at all times. Personnel shall be fully clothed in suitable work clothing.

Supervision. Contractor shall have competent supervisors, who may be working supervisors, on the job while work is being performed. Supervisors shall have a minimum of two (2) years field experience and possess adequate technical knowledge to supervise work in accordance with Contract Documents.

A non-working supervisor shall inspect job site regularly (at least two times each week) to insure work is performed in accordance with Contract Documents.

At least once each week during the maintenance period, maintenance personnel shall manually operate each remote control valve, and inspect each sprinkler head in that valve circuit, to determine proper and adequate operation.

Contractor shall adjust irrigation timing and frequency to avoid over watering and runoff, and maintain optimum soil moisture for healthy plant growth.

Rodents, insects, and other pests shall be controlled as necessary and by approved means. Restoration and repair of work areas disturbed by pest control shall be made by Contractor at no additional cost to the City.

Contractor shall immediately establish a program of pest, fungus, and weed control. Applications of pesticides, fungicides, and herbicides shall be made by operators licensed by the State of California Department of Food and Agriculture to perform

such work. Materials used in this work shall be approved by State of California Department of Food and Agriculture and other agencies with jurisdiction.

Contractor shall submit a bi-weekly maintenance reports to the City Engineer. Reports shall outline maintenance work performed in the preceding two weeks, and planned maintenance work for the following two week period. Failure to submit reports shall be deemed an interruption of the maintenance period, and shall extend the completion date of the maintenance period accordingly.

End of maintenance period shall occur only on receipt by Contractor of written final acceptance of work from the City Engineer.

Temporary facilities shall be removed from the job site.

Job site shall be thoroughly cleaned as specified in Section 308-6.

Irrigation equipment shall operate in accordance with Contract Documents and manufacturers' specifications. Adjust, repair, balance, and replace equipment not operating properly.

Record drawings shall be completed and submitted to the City. Review and approval of record drawings by the City Engineer is required prior to final acceptance.

Required material and equipment turnover items according to Section 212-2.6, and equipment maintenance instructions, shall be submitted to the City.

Contractor shall guarantee plants to be in a healthy, thriving condition for the following time periods beginning on the first day of the maintenance period:

Trees: 15 gallon and larger-ONE YEAR

Shrubs, Vines, and Ground Cover: 1 gallon and larger-120 DAYS

308-7 **GUARANTEE.** To the City Supplement, DELETE in its entirety.

308-8 **PAYMENT.** To the City Supplement, DELETE in its entirety.

SECTION 705 – WATER DISCHARGES

705-2.6.1 **General.** Paragraph (3), CORRECT reference to Section 803 to read “Section 703.”

705-2.6.3 **Community Health and Safety Plan.** To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

705-2.6.3 **Community Health and Safety Plan.** See 703-2, “Community Health and Safety Plan.”

SECTION 707 – RESOURCE DISCOVERIES

ADD:

707-1.1

Environmental Document. The City of San Diego Planning Department has prepared a **Notice of Exemption** for Park de La Cruz GDP Amendment, Project No. S-15003.02.06, as referenced in the Contract Appendix. You must comply with all requirements of the **Notice of Exemption** as set forth in the Contract **Appendix A**.

Compliance with the City's environmental document is included in the Contract Price.

END OF SUPPLEMENTARY SPECIAL PROVISIONS (SSP)

TECHNICALS

PARK DE LA CRUZ NEIGHBORHOOD PARK – PHASE I
TECHNICAL SPECIFICATIONS

DIVISION 03 – CONCRETE

031101	CONCRETE FORMWORKING FOR SKATEBOARD PARKS
032001	CONCRETE REINFORCEMENT FOR SKATEBOARD PARKS
033001	CAST-IN PLACE CONCRETE FOR SKATEBOARD PARKS
033351	CONCRETE FINISHING FOR SKATEBOARD PARKS
033701	SHOTCRETE FOR SKATEBOARD PARKS
033901	CONCRETE CURING FOR SKATEBOARD PARKS

DIVISION 05 – METAL FABRICATION

055001	METAL FABRICATION FOR SKATEBOARD PARKS
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DIVISION 09 – PAINTING

099101	PAINTING FOR SKATEBOARD PARKS
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DIVISION 06 – ELECTRICAL

260519	LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
260526	GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
260529	HANGERS AND SUPORTS FOR ELECTRICAL SYSTEMS
260533	RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS
260543	UNDERGROUND DUCTS & RACEWAYS FOR ELECTRICAL SYSTEMS
260553	IDENTIFICATION FRO ELECTRICAL SYSTEMS
260923	LIGHTING CONTROL DEVICES
262416	PANELBOARDS
265613	LIGHTING POLES AND STANDARDS
265619	LED EXTERIOR LIGHTING
265668	EXTERIOR ATHLETIC LIGHTING

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SECTION 03 11 01 – CONCRETE FORMWORK FOR SKATEBOARD PARKS

PART 1 – GENERAL

1.1 SCOPE OF WORK

- A. Furnish materials, labor, transportation, services, and equipment necessary to install all concrete formwork related to the skate park as indicated on scope of work contract and shown on drawings and as specified herein.
- B. Provide all formwork and accessories for construction of Portland Cement Concrete paving for the skate park.
- C. Related Work:
 - 1. Section 03 20 01 – Concrete Reinforcement for Skateboard Parks
 - 2. Section 03 30 01 – Cast-In-Place Concrete for Skateboard Parks
 - 3. Section 03 33 51 – Concrete Finishing for Skateboard Parks
 - 4. Section 03 37 01 – Shotcrete for Skateboard Parks

1.2 REFERENCES

- A. Comply with the applicable reference specifications as specified in the GENERAL PROVISIONS and in accordance with applicable laws, codes and regulations required by the City of San Diego, CA.
- B. Comply with the current provisions of the following Codes and Standards:
 - 1. ASTM – American Society for Testing and Materials.
 - 2. CBC – California Building Code.
 - 3. ACI – American Concrete Institute.
 - 4. Standard Specifications (as specified in the General Provisions).

1.3 QUALITY ASSURANCE

- A. Design Criteria: Conform to ACI 347-68, Chapter I.
- B. Allowable Tolerances: Conform to ACI 117 and 347-68, 2.4.
- C. CONTRACTOR Samples:
 - 1. CONTRACTOR shall prepare 4-foot x 4-foot samples for each concrete formwork type indicated on Drawings. CONTRACTOR may pour each type as part of the finished project, and if approved by the RESIDENT ENGINEER it may remain in place as finished product. If the sample is not approved, the CONTRACTOR in charge of the specific scope of work shall remove and replace another sample for RESIDENT ENGINEER'S approval.
 - 2. Mock-Ups shall be completed to the satisfaction of the RESIDENT ENGINEER including aggregates, texture, color, and finishes.
 - 3. These mock-ups will become the standard of quality by which future paving samples and work will be judged.
 - 4. Mock-ups to remain on-site and be protected during the course of construction, as a means to compare work in progress. If Mock-ups are damaged or removed, the CONTRACTOR in charge of the specific scope of work shall repair/replace in-kind immediately.
- D. Concrete Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

- E. Safety and Performance Guidelines: Comply with all safety and performance requirements and all applicable references as specified in the ASTM F2480 Standard Guide for In-ground Skate Parks.

1.4 STORAGE OF MATERIALS

- A. Store materials on and under protective sheeting.

1.5 COORDINATION

- A. Notify responsible trades of schedules of concrete pours to allow time for installation and coordination.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Forms:

1. Flatwork and Bond Beam: 1" Exterior Masonite Siding for all Tangents. 7/16" Exterior Masonite Siding for all radii. Create true arc to tangent connections as per layout plan. No kinks will be accepted.
2. Vertical and Custom Work: Exterior grade Standard Douglas Fir (or equal plywood), minimum three ply, one smooth side sufficiently thick to sustain loads, or steel forms.

- B. Form Oil: Non staining, paraffin-base oil having a specific gravity of between 0.8 and 0.9.

- C. Form Ties: Bolts, rods, or patented devices having tensile strength of 3000 lbs., adjustable length, free of lugs which would leave a hole larger than 5/8" diameter and having a full one-inch depth of break-back.

PART 3 – EXECUTION / CONSTRUCTION

3.1 CONSTRUCTION AND ERECTION

- A. Construct forms in accordance with ACI 347-68.

- B. Build forms to shapes, lines and dimensions of detailed members of concrete construction. Set to line and grade, brace and secure to withstand placing of concrete and maintain their shape and position.

- C. Construct forms with care to produce concrete surfaces without unsightly or objectionable form marks in exposed concrete surfaces.

- D. Thoroughly clean surfaces of form material and remove nails before reuse. Do not reuse damaged or worn forms. Coat contact surfaces of forms with non-staining form oil prior to placing metal reinforcement.

- E. Immediately before placing concrete, clean forms of chips, sawdust, and debris. Immediately after removal of forms, remove form ties, wires, and defects and patch.

3.2 INSERTS AND ACCESSORIES

- A. Make provisions for required installation of accessories, bolts, hangers, sleeves, anchor slots and inserts cast in concrete. Obtain suitable templates or instructions for installation of items. Place expansion joints where detailed and required, also shown in the Jointing Plan in the drawings.

3.3 REMOVAL OF FORMS AND SHORING

- A. Remove forms and shores in accordance with ACI 347-68.

3.4 CLEANUP

- A. Upon completion of the concrete formwork, remove surplus construction materials, loose earth, trash and debris so that the job site is left in a neat and orderly condition.

END OF SECTION 03 11 01

SECTION 03 20 01 – CONCRETE REINFORCEMENT FOR SKATEBOARD PARKS

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Furnish materials, labor, transportation, services, and equipment necessary to install all concrete reinforcement related to the skate park as indicated on scope of work contract and shown on drawings and as specified herein.
- B. Provide all steel reinforcement for construction of Portland Cement Concrete paving for the skate park.
- C. Related Work:
 - 1. Section 03 11 01 – Concrete Formwork for Skateboard Parks
 - 2. Section 03 30 01 – Cast-In-Place Concrete for Skateboard Parks
 - 3. Section 03 37 01 – Shotcrete for Skateboard Parks

1.2 REFERENCES

- A. Comply with the applicable reference specifications as specified in the GENERAL PROVISIONS and in accordance with applicable laws, codes and regulations required by the City of San Diego, CA.
- B. Comply with the current provisions of the following Codes and Standards:
 - 1. ASTM - American Society for Testing and Materials.
 - 2. Standard Specifications – Agency Specified
 - 3. CBC – California Building Code.
- C. American Concrete Institute (ACI):
 - 1. ACI 315-80, Manual of Standard Practice for Detailing Reinforced Concrete Structures.
 - 2. ACI 318-77, Building Code Requirements for Reinforced Concrete.
- D. American Society for Testing and Materials (ASTM - latest editions):
 - 1. ASTM A233 - Mild Steel Arc Welding Electrodes.
 - 2. ASTM A615 - Deformed Billet-Steel Bars for Concrete Reinforcement.
 - 3. ASTM A706 - Low-Alloy Steel Deformed Bars for Concrete Reinforcement.
 - 4. ASTM F2480 – Standard Guide for In-ground Concrete Skate Park.

E. Concrete Reinforcing Steel Institute (CRSI): Manual of Standard Practice, latest edition.

F. American Welding Society (AWS): Reinforcing Steel Welding Code, D1.4 and D12.1-75, including latest revisions.

1.3 DELIVERY AND STORAGE

- A. Store materials in dry and protected locations and protect from damage. Stack reinforcing steel in staggered tiers. Mark each length, size, shape and location. Maintain reinforcement free of dirt, mud, paint or rust.

1.4 SUBMITTALS

- A. In accordance with the Contract Documents, General, and Technical Provisions.

- B. Shop Drawings: Indicate complete reinforcing method for each concrete member including materials, sizes, bends, dimensions, stirrup spacing, and placing details not shown on drawings. To be reviewed by the RESIDENT ENGINEER.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Steel Reinforcement: Deformed billet steel conforming to ASTM A615, Grade 60, clean and free of rust, dirt, grease or oils. Minimum 75% Recycled Product.
- B. Welded Steel Reinforcement: Deformed low-alloy steel, ASTM A706, carbon content not exceeding 0.30% and manganese content not exceeding 0.60%. Identify and tag with manufacturer's heat identification number.
- C. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars in place.

2.2 FABRICATION

- A. Fabricate to sizes, shapes, and lengths detailed in accordance with requirements of ACI 318-71 and ACI 315-65.

PART 3 – EXECUTION / CONSTRUCTION

3.1 INSTALLATION

- A. Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars" for placing and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other bond-reducing materials.
- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover over reinforcement.
- D. Accurately place reinforcing steel in accordance with drawings. Rebar shall be 2" beneath concrete surfaces. Thoroughly clean reinforcement of any coating which would reduce bonding. Do not heat, cut, or bend bars without the RESIDENT ENGINEER'S approval. Do not splice reinforcement at points of maximum stress. Stagger splices in adjacent bars and provide a minimum overlap of 30-bar diameters at splices unless specifically noted otherwise on Drawings.
- E. Securely saddle tie intersections with No. 18 gauge black annealed wire. Rigidly secure reinforcement in place. Provide concrete coverage as shown on Drawings.

3.2 WELDING REINFORCEMENT

- A. Weld deformed steel reinforcement bars in strict accordance with AWS 12.1, using recommended pre-heat temperature and electrode for type of steel being welded.
- B. Do not weld steel reinforcement bars without proper heat identification of bars.

3.3 CLEANUP

- A. Upon completion of the concrete reinforcement work, remove surplus construction materials, loose earth, trash and debris so that the job site is left in a neat and orderly condition.

END OF SECTION 03 20 01

SECTION 03 30 01 – CAST-IN-PLACE CONCRETE FOR SKATEBOARD PARKS

PART 1 – GENERAL

1.1 SCOPE OF WORK

- A. Furnish materials, labor, transportation, services, and equipment necessary to install all Portland Cement Cast-In-Place Concrete related to the skate park as indicated on scope of work contract and shown on drawings and as specified herein.
- B. Related Work:
 - 1. Section 03 11 01 – Concrete Formwork for Skateboard Parks
 - 2. Section 03 20 01 – Concrete Reinforcement for Skateboard Parks
 - 3. Section 03 33 51 – Concrete Finish for Skateboard Parks
 - 4. Section 03 37 01 – Shotcrete for Skateboard Parks
 - 5. Section 03 39 01 – Concrete Curing for Skateboard Parks

1.2 REFERENCES

- A. Comply with the applicable reference specifications as specified in the GENERAL PROVISIONS and in accordance with applicable laws, codes and regulations required by the City of San Diego, CA. Comply with the current provisions of the following Codes and Standards.
- B. ASTM - American Society for Testing and Materials:
 - 1. ASTM C33 – Concrete Aggregates.
 - 2. ASTM C94 – Ready-Mixed Concrete.
 - 3. ASTM C143 – Test for Slump of Portland Cement Concrete.
 - 4. ASTM C150 – Portland Cement.
 - 5. ASTM C260 – Air-Entraining Admixtures for Concrete.
 - 6. ASTM C494 – Chemical Admixtures for Concrete.
 - 7. ASTM C618 – Fly Ash and Raw or Calcined Natural Pozzalans for Use in Portland Cement Concrete
 - 8. ASTM F2480 – Standard Guide for In-ground Concrete Skate Park.
- C. ACI – American Concrete Institute:
 - 1. ACI 211.1-81 – Recommended Practice for Selecting Proportions for Normal-Weight Concrete.
 - 2. ACI 211.3-81 – Recommended Practice for Selecting Proportions for Lightweight Concrete.
 - 3. ACI 301-73 – Specifications for Structural Concrete for Buildings.
 - 4. ACI 305-77 – Recommended Practice for Hot Weather Concreting.
 - 5. ACI 306-72 – Recommended Practice for Cold Weather Concreting.
 - 6. ACI 318-77 – Building Code Requirements for Reinforced Concrete.
- D. CBC – California Building Code.
- E. AWS – American Welding Society
 - 1. AWS 3.0 – Standard Qualifications Procedure.
 - 2. AWS D1.4 – Structural Welding Code – Reinforcement.
 - 3. AWS D12.1 – Reinforced Concrete Construction.
- F. CRSI – Concrete Reinforcing Steel Institute: MSP-1 – Manual of Standard Practice

1.3 SUBMITTALS

- A. Design of Concrete Mixes:

1. CONTRACTOR shall be responsible for and pay for design of concrete mixes. Design of concrete mixes shall be performed by a Testing Laboratory selected by CONTRACTOR and reviewed and approved by the RESIDENT ENGINEER. Design methods to be in accordance with ACI 318-71.
 2. Make three trial mixes using aggregate proposed.
 3. Make advance tests of trial mixes with proposed materials. Test four cylinders in accordance with ASTM C39 at 7 days and 28 days. Do not place concrete on project until laboratory reports and breaks of confirmations cylinders indicate that the proposed mixes will meet the strength requirements.
 4. Check mix design and revise, if necessary, wherever changes are made in aggregate or in surface water content of aggregate or workability of concrete. Slump shall be the minimum to produce workable mix. Laboratory shall prescribe minimum quantity of water.
 5. If Portland Cement reducers or other additives are used, submit control mix design without reducers or additives as well as mix exactly proposed to be used. Submit W.R. Grace Co. recommendations for retarder and shrinkage compensation of slab on grade.
 6. Sample of Workmanship: Provide on-site, minimum one (1) 48"x48" sample. CONTRACTOR may pour each type as part of the finished project. It shall be reviewed by the RESIDENT ENGINEER, if approved it may remain in place as finished product. If the sample is not approved, CONTRACTOR in charge of the specific scope of work shall remove and replace another sample for the RESIDENT ENGINEER'S approval.
 7. Samples for Color Selection: Submit color additive manufacturer's color chart & sample chip set; indicate color additive number and required dosage rate. Samples indicate general color and may vary from concrete finished in field according to Specifications.
 8. Forward two copies of design mix to the RESIDENT ENGINEER and SKATE PARK CONSULTANT.
- B. Submit product data and manufacturer's instructions for:
1. Color admixture.
 2. Expansion joint fill material.
 3. Curing compound.
 4. Dowel aligners/caps.
 5. Waterstop.
 6. Crack repair materials.
 7. Form facing materials.
 8. Proprietary cleaning agents.
 9. Plastic film for curing.
 10. Surface retarders.
- C. Samples:
1. Samples for Color Selection: Submit color additive manufacturer's color chart & sample chip set; indicate color additive number and required dosage rate. Samples indicate general color and may vary from concrete finished in field according to Specifications.
 2. Expansion Joint Fill Material: Submit one 12-inch length.
- D. Test Reports: Compressive strength of concrete test cylinders taken upon delivery of concrete.
- E. Delivery Documentation: Batch tags for each load of concrete, for informational purposes.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Meet requirements of applicable laws, codes, and regulations required by authorities having jurisdiction over Work.
- B. CONTRACTOR Mock-ups:
 - 1. CONTRACTOR shall prepare 4-foot x 4-foot samples for each cast-in-place concrete type indicated on Drawings. CONTRACTOR may pour each type as part of the finished project, and if approved by the RESIDENT ENGINEER it may remain in place as finished product. If the sample is not approved, the CONTRACTOR in charge of the specific scope of work shall remove and replace another sample for RESIDENT ENGINEER'S approval.
 - 2. Mock-Ups shall be completed to the satisfaction of the RESIDENT ENGINEER including aggregates, texture, color, and finishes.
 - 3. These mock-ups will become the standard of quality by which future paving samples and work will be judged.
 - 4. Mock-ups to remain on-site and be protected during the course of construction, as a means to compare work in progress. If Mock-ups are damaged or removed, the CONTRACTOR in charge of the specific scope of work shall repair/replace in-kind immediately.
- C. Concrete Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
- D. Safety and Performance Guidelines: Comply with all safety and performance requirements and all applicable references as specified in the ASTM F2480 Standard Guide for In-ground Skate Parks.
- E. ACI Requirements: Meet all requirements of ACI 301.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials in dry and protected locations and protect from damage.
- B. Do not change brand of cement or source of aggregate during course of Work, without prior approval from the RESIDENT ENGINEER.

1.6 SITE CONDITIONS

- A. Environmental Requirements:
 - 1. CONTRACTOR shall submit plan to monitor wind velocity, relative humidity, temperature, and concrete temperature in order to maintain specified maximum rate of evaporation.
 - 2. Do not place concrete when sub base surface temperature is less than 40 degrees F, nor when surface is wet.
 - 3. Protect concrete against extreme cold and heat, frost, rapid drying, and damage by rain.
- B. Coordination:
 - 1. Coordinate schedules of concrete placement to allow adequate time for installation of other related work.
 - 2. Verify that anchor bolts and other embedded steel items to be cast into concrete are properly placed.
 - 3. Coordinate size and location of mechanical and electrical equipment concrete pads.
 - 4. Coordinate earthwork and soils report requirements with placement requirements.
 - 5. Coordinate with form-work and finishes sections to provide finish floor levelness and flatness as specified herein. Slope to drains at grades and percent slope shown on contract documents.
 - 6. Ensure that irrigation sleeves, electrical conduit, drainage lines and other utility elements are accommodated and as-built located prior to placing concrete.

1.7 WARRANTY

- A. General Description: In addition to manufacturer's warranties, warrant Work for a period of one year from the Date of Final Completion against defects in materials and workmanship.
- B. Additional Items Covered: Warranty shall also cover repair of damage to other materials and workmanship resulting from defects in materials and workmanship. Also refer to Responsibilities of the Contractor in the Green Book and White Book.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Ready Mixed Concrete: Batched, mixed and transported in accordance with ASTM C94 – Specifications for Ready Mixed Concrete.
- B. Portland Cement: Refer to Drawings for specific paving type and finish required and conform to ASTM C-150, Type II. Use same brand of cement from single source throughout entire project for each paving type, unless approval from the RESIDENT ENGINEER states otherwise.
- C. Fine Aggregate (washed concrete sand): Clean, hard, durable, uncoated washed natural sand, free from silt, loam or clay, and conforming to ASTM C33.
- D. Coarse Aggregate: Class II-Hard durable, un-coated crushed limestone meeting requirements of ASTM C-33. Unless otherwise noted in aggregate size 1" minimum, No., 56 or 57. Base rock shall conform to local code.
- E. Water: Potable and free from deleterious materials such as oils, acids, and organic matter.
- F. Admixture: Cement-dispersing, water-reducing compound, ASTM C 494, Type A, as made by Master Builders, Sika, or Gifford-Hill Co., or equal. Depending upon weather conditions at time of placing, ASTM C 494, Type D (water-retarding) or Type E (water-reducing, accelerating) may be used if approved by the RESIDENT ENGINEER.
- G. Curing Materials:
 - 1. Water: Domestic Quality, clear and potable with no chemical content.
 - 2. Sheet Material: Comply with ASTM C171. Moisture loss maximum .055 g/cm sq. Color: White.
 - 3. Curing Compounds/Sealer: Curing compound shall comply with ASTM C309 and be approved by color additive manufacturer for use with colored concrete

2.2 PROPORTIONS AND MIXING

- A. Proportions and Design: In accordance with approved mix design. Minimum allowable compressive strength at 28 days is 4000 psi (as marked per plan).
- B. Admixture: No admixtures without approval of the Resident Engineer. Introduce admixtures in quantities and according to methods recommended by admixture manufacturer. Add air-entraining agent to concrete as scheduled.
- C. Slump: Not to exceed 3 1/2"
- D. Mixing: Ready mixed concrete in accordance with ASTM C-94. Do not transport or use concrete after 1-1/2 hours have elapsed from time of initial mixing. Supplier of transit-mixed concrete shall have a plant of sufficient capacity, and adequate transportation facilities to assure continuous delivery at required rate, to provide continuous concrete placement throughout a pour.

- E. Grout and Dry Pack: Non-Shrink, Non-Metallic: U.S. Grout Corp or equal. "Five Star Grout" ASTM C-827, C-1107-02 Grades A, B and C, and C-1107-07, 5,000 PSI.

2.3 CURING MATERIALS

- A. Water: Domestic Quality, clear and potable with no chemical content.
- B. Sheet Material: ASTM C171. Moisture loss maximum .055 g/ cm sq. Color: White.
- C. Curing Compounds: Ashford Formula™ Curecrete by Curecrete Distribution, Inc., Phone (800) 998-5664, or equal.

PART 3 – EXECUTION / CONSTRUCTION

3.1 INSPECTION

- A. Inspect subgrade, forms, reinforcing steel, pipes, conduits, sleeves, hangers, anchors, inserts, and other work required to be built into concrete and report any discrepancies. Notify CITY at least five (5) working days in advance of scheduled placement.
- B. Correct unsatisfactory work prior to placing concrete.
- C. Remove rubbish from formwork immediately prior to placing concrete.

3.2 INSTALLATION

- A. Placing Concrete:
 - 1. Convey and place concrete allowing no separation of ingredients in accordance with ACI 304 and as specified below.
 - 2. Maximum height of concrete free fall – five (5) feet.
 - 3. Regulate rate of placement to maintain plasticity and flow into position.
 - 4. Deposit concrete continuously until panel or section is completed.
 - 5. Place concrete in horizontal layers 18" maximum thickness.
- B. Consolidation:
 - 1. Use mechanical vibrating equipment for consolidation.
 - 2. Vertically insert and remove hand-held vibrators at 18" O.C. for 10 to 15 seconds.
 - 3. Do not use vibrators to transport concrete in forms.
 - 4. Provide vibrators with minimum speed of 8000 RPM and with amplitude to consolidate effectively.
 - 5. Thoroughly consolidate concrete and work around reinforcement, embedded items and into corners of forms. Thoroughly consolidate layers of concrete with previous layers.
- C. Construction Joints:
 - 1. Unless otherwise shown on Drawings, each footing, wall, beam, and slab shall be considered as a single unit of operation and shall be monolithic in construction.
 - 2. Where construction joints are absolutely unavoidable, locate joints at or near quarter points of spans where approved by RESIDENT ENGINEER and/or shown on plan.
 - 3. Saw Cut joints, Expansion Joints and Cold Joints as detailed in contract documents.
- D. Expansion Joint Fillers:
 - 1. Refer to Drawings for Expansion Joint locations and details.
 - 2. Finish joint material flush with concrete surface.

E. Hot Weather Placement:

1. Prevent high temperature in fresh concrete during hot weather in accordance with ACI 305.
2. Use water reducing set retarding admixtures in such quantities as especially recommended by manufacturer to assure that concrete remains workable and lift lines will not be visible.

F. Flatwork:

1. Cast slabs-on-grade in alternate sections, unless permanent forms are used. Wait 48 hours between all adjacent concrete castings.
2. Plane Surface Tolerance: Exterior- Class AX, 3/16" in 10' with no ponding.
3. Maximum 1:500 slope from indicated plane at any point.

G. Finish:

1. Smooth Trowel finish to match approved Mock-Up finish. If the finish is not approved, the CONTRACTOR in charge of the specific scope of work shall remove and replace another sample for RESIDENT ENGINEER'S approval.
2. After surface water disappears and floated surfaces have sufficiently hardened, steel trowel then retrowel the surface to a smooth and consistent finish.
3. After concrete has set enough to provide edge troweling, retrowel edges to a smooth and uniform finish.

H. Cracking:

1. Cracking from inadequate curing is not allowed. Sawcut joints and construction joints are shown on drawings. CONTRACTOR may, with review and approval by the RESIDENT ENGINEER, recommend and detail other joints required to prevent cracking.

3.3 REPAIRS AND PROTECTION

- A. Remove and replace concrete paving that is broken, damaged, defective, or does not meet the requirements of this Section or conformance with ASTM F 2480 - Standard Guide for In-ground Skate Parks.
- B. Protect concrete from damage; exclude traffic from paving for at least 28 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
- C. Maintain concrete paving free of stains, discoloration, dirt, wax, and other foreign material.

3.5 TOLERANCES

- A. Minor variations in appearance of colored concrete, which are similar to natural variations in color and appearance of uncolored concrete, are acceptable but subject to approval by the RESIDENT ENGINEER.

3.4 REJECTIONS

- A. Mock-Ups shall be completed to the satisfaction of the RESIDENT ENGINEER including aggregates, texture, color, and finishes. If mock-ups are rejected by the RESIDENT ENGINEER, the CONTRACTOR in charge of the specific scope of work shall remove and replace mock up for the RESIDENT ENGINEER's approval at no additional cost to the CITY.
- B. If Mock-ups are damaged, removed, the CONTRACTOR in charge of the specific scope of work shall repair/replace in-kind immediately at no additional cost to the CITY.
- C. Major variations in the appearance of integral colored concrete compared to manufacturer's sample chip shall be rejected by the RESIDENT ENGINEER. The CONTRACTOR in charge of the specific scope of

work shall remove and replace mock up for the RESIDENT ENGINEER'S approval at no additional cost to the CITY.

- D. Defects in the concrete including lack of uniformity, exhibits segregation honeycombing, or lamination, or which contains any dry patches, slugs, voids, or pockets shall be rejected by the RESIDENT ENGINEER. The CONTRACTOR in charge of the specific scope of work shall remove and replace mock up for the RESIDENT ENGINEER'S approval at no additional cost to the CITY.

3.6 CLEAN UP

- A. At completion of Work, remove concrete stains from adjacent work, including but not limited to dissimilar paving types, walls, columns, railing posts, light fixtures, plant materials, to satisfaction of the RESIDENT ENGINEER.

END OF SECTION 03 30 01

SECTION 03 33 51 – CONCRETE FINISHING FOR SKATEBOARD PARKS

PART 1 – GENERAL

1.1 SCOPE OF WORK

- A. All work contained in this Section is considered specialty Skateboard Park construction. Only those contractors that meet the minimum experience requirements contained in the QUALITY ASSURANCE Section of this specification may perform this work as specified herein.
- B. This section identifies the qualifications that the Bidder and/or Subcontractors shall meet prior to award of the Contract.
- C. Complete qualifications and this form must be turning in WITH THE BID.

1.2 Regulations: The work shall conform to requirements of the American Concrete Institute (ACI) and the California Building Code (CBC) for concrete finishing, as supplemented and modified on drawings or herein.

1.3 REFERENCE STANDARDS: The Concrete Finishing shall conform to requirements of the following Reference Standards or as modified and supplemented hereinafter.

- A. American Concrete Institute (ACI) Specifications for Structural Concrete for Buildings, ACI 301
- B. ACI Recommended Practice for Cold Weather Concreting, ACI 306
- C. ACI Recommended Practice for Hot Weather Concreting, ACI 605

1.4 RELATED SECTIONS:

Section 03 11 01 - Concrete Formwork for Skateboard Parks
Section 03 20 01 - Concrete Reinforcement for Skateboard Parks
Section 03 30 01 - Cast in Place Concrete for Skateboard Parks
Section 03 37 01 - Shotcrete for Skateboard Parks

1.5 QUALITY ASSURANCE:

- A. Skateboard Parks are not considered standard concrete flatwork. Where indicated to be exposed, Skateboard Park concrete is architecturally finished concrete represented in the form of complex and unique shapes. Typical Skateboard Park features will incorporate concave and convex transitioning between surfaces which require the specified finishes to sculpturally blend along compound radius curves. It is critical that Skateboard Park concrete work be completed with a high level of precision for the skate facility to function properly and safely. Special care must be taken to provide the specified finished surfaces without gravel pockets, and other defects/defacements. The Resident Engineer shall inspect concrete after removal of forms and before concrete repair work begins. Concrete that does not meet the minimum requirements of the specifications shall be rejected by the Resident Engineer and removed and replaced in its entirety by the Contractor at the Contractor's expense.

1.6 SUBMITTALS:

Refer to the following related specifications for submittal requirements:

1. Section 03 11 01 – Concrete Formwork for Skateboard Parks
2. Section 03 20 01 – Concrete Reinforcement for Skateboard Parks
3. Section 03 30 01 – Cast-In-Place Concrete for Skateboard Parks
4. Section 03 39 01 – Concrete Curing for Skateboard Parks
5. Section 05 50 01 – Metal Fabrications for Skateboard Parks

- 1.7 PROTECTION: Protect persons and adjacent materials and finishes from dust, dirt and other surface or physical damage during finishing operations, including materials driven by wind.

PART 2 - PRODUCTS *Not Applicable*

PART 3 – EXECUTION

3.1 REPAIRS:

- A. Immediately after the removal of forms inspect all surfaces for defects.
- B. Repair or patch defects only after defects are inspected by the RESIDENT ENGINEER and then only with the RESIDENT ENGINEER'S permission. Do all cutting and repair within 48 hours after removal of forms; cure repairs same as new concrete.

3.2 FINISHES FOR FORMED SURFACES:

- A. Rough Form Finish: Provide for surface of walls and footings adjacent to grade or below grade. This is the concrete surface having texture imparted by form facing material use with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.
- B. Smooth Formed Finish: Provide a smooth formed finish on formed concrete surfaces exposed to view. This is an as-cast concrete surface obtained with selected form facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Remove fins and other projections completely and smoothed. Repair and patch honeycombs and defective areas as directed by the RESIDENT ENGINEER. Tie holes shall not be filled.
- C. Sacked Finish:
 1. On all inconsistent surfaces of the exposed concrete, provide a sacked finish by coating the concrete with sacking mortar. Sacking of patched or defective concrete surfaces may be required by the RESIDENT ENGINEER for areas not otherwise already requiring this work.
 2. Repair and patch tie holes, honeycombs and defective areas and trowel to smooth finish. Remove fines and other projections completely.
 3. Thoroughly wet surface to prevent absorption.

4. Coat entire surface with sacking mortar as soon as surface of concrete approaches surface dryness.
 5. Thoroughly and vigorously rub mortar over area with clean burlap pads to fill all voids.
 6. While mortar is still plastic but partially set (so it cannot be pulled from voids), sack-rub surface with dry mix of sacking mortar (leave out water). There should be no discernible thickness of mortar on concrete surface, except in voids; all surfaces should be uniformly textured.
 7. Immediately begin a continuous moist cure for 72 hours.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated. Provide for face surface of walls adjacent to plaza, walks and stairs.

3.3 FINISHES FOR UNFORMED SURFACES:

- A. Screed all slabs, for whatever finishes, to true levels or slopes, work surfaces only to the degree required to produce the desired finish; do no finishing in areas where water has accumulated until they have been drained and excess moisture has dried. Carefully finish all joints and edges with proper tools, unless otherwise specified.
- B. Rough Screed Finish: Consolidate, level, and screed all surfaces to obtain evenness and uniformity; remove all surplus concrete after consolidation by striking off with sawing motion against guide strips.
- C. Float Finish: Apply float finish to monolithic slabs to receive trowel or other finishes. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using floats appropriate to the surface contours only, when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to tolerances of F(F) 18 (floor flatness) and F(L) 15 (floor levelness) measured according to ASTM E 1155. Uniformly slope surfaces to drains. Cut down high spots and fill low spots immediately after leveling, re-float surface to a uniform, smooth, granular texture.
- D. Hard Trowel Finish: After floated surface is firm enough to receive steel trowels, trowel at least two complete passes, or until last stage before blackening. Leave no trowel marks discernible to the touch. Do not use excessive water, especially on last the pass.
- E. Defective Work: Remove and replace when directed by the RESIDENT ENGINEER, surfaces which show inferior finish quality.

3.4 CURING:

- A. Protect concrete surfaces against rapid drying. Apply Clear Spray-on cure agent after final finish is achieved. Keep sealed with cure agent for necessary amount of time to reach concrete strength and inhibit moisture loss after placing per manufacturer's recommendation.

B. Duration of Curing: In addition to the initial overnight curing, continue final curing operations until the cumulative number of days or fractions thereof (not necessarily consecutive) occurs, during which time the temperature of the air in contact with the concrete is above 50 degrees F, equals 7 days. Curing period considered done when compressive strength is reached. If high-early strength concrete has been used, continue final curing operation for 3 days total time, calculated as before. Take care to prevent rapid drying at the end of the curing period. Early removal of forms will not be approved when forms are removed during the curing period.

3.5 INSPECTION:

Contractor shall notify RESIDENT ENGINEER that they are starting concrete finish repair work at least 5 days prior to the beginning of work.

3.6 REJECTIONS:

- A. Major variations in the appearance of integral colored concrete compared to manufacturer's sample chip shall be rejected by the RESIDENT ENGINEER. The CONTRACTOR in charge of the specific scope of work shall remove and replace mock up for the RESIDENT ENGINEER'S approval at no additional cost to the CITY.
- B. Defects in the concrete including lack of uniformity, exhibits segregation honeycombing, or lamination, or which contains any dry patches, slugs, voids, pockets or does not meet the radius requirements of the design shall be rejected by the RESIDENT ENGINEER. The CONTRACTOR in charge of the specific scope of work shall remove and replace mock up for the RESIDENT ENGINEER'S approval at no additional cost to the CITY.

3.7 CLEANING: Leave premises clean and free of residue from work in this section.

3.8 PROTECTION AND SITE SECURITY FROM VANDALISM: It shall be the contactors responsibly to protect site from theft and vandalism.

END OF SECTION 03 33 51

SECTION 03 37 01 – SHOTCRETE FOR SKATEBOARD PARKS

PART 1 – GENERAL

1.1 SCOPE OF WORK

- A. Furnish materials, labor, transportation, services, and equipment necessary to install all Shotcrete related to the skate park as indicated on scope of work contract and shown on drawings and as specified herein.
 - 1. Provide sprayed-on concrete (concrete conveyed into place by air pressure through a flexible tube or gun with controlled nozzle) referred to herein as shotcrete, complete as shown and as specified.
 - 2. Application, cutting, and sculpting and finish work related to this Work is deemed sole source specialty work within the Contract Documents.
 - 3. All work related to this application, cutting, sculpting, and installation shall be coordinated with the RESIDENT ENGINEER, prior to project start.
- B. Refer to Drawings for specific locations of shotcrete.
- C. Related Work:
 - 1. Section 03 11 01 – Concrete Formwork for Skateboard Parks
 - 2. Section 03 20 01 – Concrete Reinforcement for Skateboard Parks
 - 3. Section 03 30 01 – Cast-In-Place Concrete for Skateboard Parks
 - 4. Section 03 33 51 – Concrete Finishing for Skateboard Parks
 - 5. Section 03 39 01 – Concrete Curing for Skateboard Parks
 - 6. Section 05 50 01 – Metal Fabrications for Skateboard Parks

1.2 REFERENCES

- A. Comply with the applicable reference specifications as specified in the GENERAL PROVISIONS and in accordance with applicable laws, codes and regulations required by the City of San Diego, CA. Comply with the current provisions of the following Codes and Standards:
- B. ASTM - American Society for Testing and Materials:
 - 1. ASTM C33 – Concrete Aggregates.
 - 2. ASTM C39 – Test Method of Compressive Strength of Cylindrical Concrete Specimens.
 - 3. ASTM C94 – Ready-Mixed Concrete.
 - 4. ASTM C143 – Test for Slump of Portland Cement Concrete.
 - 5. ASTM C150 – Portland Cement.
 - 6. ASTM C260 – Air-Entraining Admixtures for Concrete.
 - 7. ASTM C494 – Chemical Admixtures for Concrete.
 - 8. ASTM C979 – Pigments for Integrally Colored Concrete.
 - 9. ASTM C618 – Fly Ash and Raw or Calcined Natural Pozzolans for Use in Portland Cement Concrete.
 - 10. ASTM F2480 – Standard Guide for In-ground Concrete Skate Park.
- C. ACI – American Concrete Institute:
 - 1. ACI 211.1 – Recommended Practice for Selecting Proportions for Normal-Weight Concrete.
 - 2. ACI 211.2 – Recommended Practice for Selecting Proportions for Lightweight Concrete.
 - 3. ACI 301 – Specifications for Structural Concrete for Buildings.
 - 4. ACI 305 – Recommended Practice for Hot Weather Concreting.
 - 5. ACI 306 – Recommended Practice for Cold Weather Concreting.

6. ACI 318 – Building Code Requirements for Reinforced Concrete.

D. CBC – California Building Code

E. AWS – American Welding Society

1. AWS 3.0 – Standard Qualifications Procedure.
2. AWS D1.4 – Structural Welding Code – Reinforcement.
3. AWS D12.1 – Reinforced Concrete Construction.

F. CRSI – Concrete Reinforcing Steel Institute: MSP-1 – Manual of Standard Practice

1.3 SUBMITTALS

A. Manufacturer's Data: Current printed specifications with application and installation instruction for proprietary materials including concrete admixtures.

B. Shop Drawings: Radial templates cut to exact radii shown on drawings to insure exact radii from flat bottom of Skate Park to face of coping. Template shall be fabricated from steel or 3/4" Plywood.

C. Design of Concrete Mixes:

1. CONTRACTOR shall be responsible for and pay for design of concrete mixes for each type of concrete specified. Design of concrete mixes shall be performed by a Testing Laboratory selected by CONTRACTOR and approved by the RESIDENT ENGINEER. Design methods to be in accordance with ACI 318.
2. Make three trial mixes using aggregate proposed.
3. Make advance tests of trial mixes with proposed materials. Test four cylinders in accordance with ASTM C-42 at 7 days and 28 days. Do not place concrete on project until laboratory reports and breaks of confirmation cylinders indicate that proposed mixes will develop required strengths.
5. When the length of a core is less than twice the diameter, apply the correction factors given in ASTM C42 to obtain the compressive strength of individual cores. The average compressive strength of three cores taken from the structure, representing a shift or 50 cubic yards of shotcrete, must equal or exceed 0.85f_c with no individual core less than 0.75f_c.
4. Check mix design and revise, if necessary, wherever changes are made in aggregate or in surface water content of aggregate or workability of concrete. Slump shall be the minimum to produce workable mix. Laboratory shall prescribe minimum quantity of water.
5. If Portland cement reducers or other additives are used, submit control mix design without reducers or additives as well as mix exactly proposed to be used. Submit W.R. Grace Co. recommendations for retarders and shrinkage compensation of slab on grade.
6. Sample of Workmanship: Provide on-site, minimum one (1) 48"x48" sample. CONTRACTOR may pour each type as part of the finished project. It shall be reviewed by the RESIDENT ENGINEER, if approved it may remain in place as finished product. If the sample is not approved, CONTRACTOR in charge of the specific scope of work shall remove and replace another sample for the RESIDENT ENGINEER'S approval.
7. Forward two copies of design mix to the RESIDENT ENGINEER and SKATE PARK CONSULTANT.

D. Acceptance

Final acceptance of the shotcrete will be based upon the results obtained from cores. Use of data obtained from impact devices will not be permitted for final acceptance of the shotcrete. However, these data may be useful for determining uniformity of the shotcrete.

- E. Submit product data and manufacturer's instructions for:
1. Color admixture.
 2. Expansion joint fill material.
 3. Curing compound.
 4. Dowel aligners/caps.
 5. Crack repair materials.
 6. Form facing materials.
 7. Form release agents.
 8. Proprietary cleaning agents
 9. Plastic film for curing.
 10. Surface retarders.
- F. Shotcrete Sample:
1. Provide representative samples of materials for material testing, mix proportion testing, and finish.
 2. Sample of each of the following must be provided: Bowl section with pool coping and tile, outside transition hip with 2" round steel coping, stamped concrete china bank, and a standard bank. The location and type of sample is identified in the construction documents on SK-1.2 Concrete Material Plan. The shotcrete samples need to match the same height, radius, angle, curvature, finish, and reinforcement of the corresponding sections and details for inspection and approval. The sample may be part of the finished product and can remain in place as finished product if approved by the RESIDENT ENGINEER. If the sample is built in place it needs to follow the jointing outlined in the Jointing plan. If the samples are built elsewhere onsite they only need to be 6' wide with height and length corresponding to the sections.
- G. Placement Schedule:
1. CONTRACTOR to indicate on plans the locations to be shot within a day's work and not exceeding 50 cubic yards per day for quality control and inspection schedules.
 2. Schedule and sequence to be reviewed and approved the RESIDENT ENGINEER prior to starting this Work.
- H. Test Reports: Compressive strength of concrete test cylinders taken upon delivery of concrete.
- I. Delivery Documentation: Batch tags for each load of concrete, for informational purposes.

1.4 QUALITY ASSURANCE

- A. Concrete Testing:
1. Prepare test specimens by each application crew using the equipment, materials and mix proportions proposed for the RESIDENT ENGINEER shall observe preparation of test panels noting placement of shotcrete by applications crew.
 2. Test panel shall be at least 6'x6'x6' with the same reinforcement as in the proposed structure. A testing agency shall take at least (3) cores from the specimen and test them in accordance with ASTM C42.
 3. Secure and protect Test Panels during construction and test for compliance with Specifications.
 4. Test strength of the shotcrete as work progresses as follows:
 - a. Cut cores from the structure and test in accordance with ASTM C42.
 - b. A set of three (3) cores shall be taken not less than once each shift nor less than one for each 50 cubic yards of shotcrete placed through the nozzle.
 - c. Cores shall be soaked in water for a minimum of 40 hours before testing.
- B. Certification: Nozzleman certification shall be in accordance with ACI 506.3R
- C. Regulatory Requirements: Meet requirements of applicable laws, codes, and regulations required by authorities having jurisdiction over Work.

- D. Acceptance: Final acceptance of the shotcrete will be based upon the results obtained from cores. Use of data obtained from impact devices will not be permitted for final acceptance of the shotcrete. However, these data may be useful for determining uniformity of the shotcrete.
- E. CONTRACTOR Mock-Ups:
 - a. CONTRACTOR shall prepare a mock-up for each paving type indicated on Drawings, prior to installation.
 - b. Mock-Ups shall be completed to the satisfaction of the RESIDENT ENGINEER including aggregates, texture, color, and finishes.
 - c. These mock-ups will become the standard of quality by which future paving samples and work will be judged.
 - d. Mock-Ups to remain on-site and be protected during the course of construction, as a means to compare work in progress. If mock-ups are damaged or removed, CONTRACTOR shall repair/replace in-kind immediately.
- F. Concrete Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
- G. Safety and Performance Guidelines: Comply with all safety and performance requirements and all applicable references as specified in the ASTM F2480 Standard Guide for In-ground Skate Parks.
- H. ACI Requirements: Meet all requirements of ACI 506, Chapter 13, Wet Method and Chapter 5, Shotcrete Crew.

1.5 DELIVERY, HANDLING, AND STORAGE

- A. Properly deliver and handle materials to prevent contamination, segregation or damage to materials.
- B. Store cement in weathertight enclosures to protect against dampness and contamination.
- C. Prevent segregation and contamination of aggregates by proper arrangement and use of stockpiles.
- D. Store admixtures properly to prevent contamination, evaporation, or other damage.
- E. Do not change brand of cement or source of aggregate during course of Work.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

- A. Portland Cement: ASTM C150, Type I or II, one brand only.
- B. Normal Weight Aggregates: ASTM C33 and as herein specified. Aggregate shall comply with gradation No. 2 as shown in ACI 506R Table 2.1. If the RESIDENT ENGINEER can show satisfactory performance of an alternate grading under similar conditions of use, they may waive the requirement for gradation No. 2.

Combined gradation of coarse and fine aggregate as follows:

Sieve Size U.S. Standard <u>Square Mesh</u>	Percent by Weight <u>Passing Individual Sieves</u>
3/8 in	90-100

No. 4	70-85
No. 8	50-70
No. 16	35-55
No. 30	20-35
No. 50	8-20
No. 100	2-10

2. Batch fine coarse aggregates separately to avoid segregation.
3. Aggregates shall be free from clay, mud, loam, or other deleterious substances.
4. Dune sand, bank run sand, and manufactured sand are not acceptable for fine aggregate.
5. Coarse aggregate shall be clean, un-coated, heavy media processed aggregate of crushed stone or river washed aggregate.

2.2 ACCESSORIES

- A. Water: Fresh, clean, potable, and free of deleterious acids, mixing, and curing water, as available from RESIDENT ENGINEER. Transport as required.
- B. Admixtures: Use only accepted admixtures meeting the following requirements:
 1. Chemical Admixtures: ASTM C494
 2. Water reducing, retarding or accelerating admixtures shall conform to ASTM C.
 3. Air-entraining Admixtures: ASTM C1141. Air entraining prior to shooting shall be 7% with a +/- 1-1/2% tolerance.
 4. The use of Calcium Chloride shall not be permitted.
- C. Cold Joints: See Cast-In-Place Concrete for skateboard parks.

2.3 PROPORTIONING AND DESIGN OF CONCRETE MIXES

- A. Mix: Prepare design mix to achieve an in-place 28 day compressive strength of 4,000 pounds per square inch and an air content of 4% at 28 days. Maximum aggregate size shall not exceed 3/8 inch. Unit weight of in-place shotcrete shall be 494 pounds per cubic yard. Use an independent Testing agency acceptable to the RESIDENT ENGINEER to prepare and report the proposed mix design. Testing is at the cost of the CONTRACTOR responsible for this mix.
- A. Test Data: Submit for acceptance proportioning and test data from prior experience if available. If data from prior experience are not available or accepted, make and have tested specimens from three or more different mix proportions in accordance with pre-construction testing requirements of this Specification.
- C. Strength: Selected mix proportions on the basis of compressive strength tests of specimens shall be cut from the shotcrete test panels not earlier than 5 days after placing. For mix acceptance purposes, average core strengths shall be least equal to f_c for cores with L/D of 2.0. For cores with L/D between 1.0 and 2.0, use correction factors given in ASTM C42.
- D. Review: Mix design shall be reviewed for acceptance by the RESIDENT ENGINEER.

2.4 CONCRETE APPLICATION EQUIPMENT

- A. For Wet Mix Shotcrete:
 1. Mixing Equipment: Capable of thoroughly mixing aggregate, cement and water in sufficient quantity to maintain continuous placement.

2. Ready-mixed Concrete: ASTM C94, except that it may be delivered to the site in the dry state if the equipment is capable of adding the water and mixing it satisfactorily with the dry ingredients.
3. Air Supply: Clean air adequate for maintaining sufficient nozzle velocity for parts of work, and for simultaneous operation of blow pipe for cleaning away rebound.
4. Delivery Equipment: Capable of discharging aggregate-cement-water mixture accurately, uniformly, and continuously through delivery hose.

PART 3 –EXECUTION / CONSTRUCTION

3.1 INSPECTION

- A. Examination: Examine concrete formwork and verify that it is true to line and dimension, adequately braced against vibration, and constructed to permit escape of air and rebound but to prevent leakage during shotcreting. Correct deficiencies.
- B. Inspection: Inspect reinforcement steel and items to be embedded in concrete. Correct any deviations.
- C. Notification: Notify other trades involved in ample time to permit the proper installation of their work. Cooperate in setting such work.
- D. Existing Surfaces: Examine existing concrete surfaces for unsound material. Correct deficiencies.

3.2 PREPARATION FOR INSTALLATION OF CONCRETE

- A. Forms: Use a form-coating material on removable forms to prevent absorption of moisture and to prevent absorption of moisture and to prevent bond with shotcrete.

3.3 CONCRETE BATCHING AND MIXING

- A. Proportions: Mix proportions shall be controlled by weight batching. CONTRACTOR'S Testing Laboratory shall maintain quality control records during shotcrete production and make those records available to the RESIDENT ENGINEER.

3.4 CONCRETE PLACEMENT

- A. Placement: Use suitable delivery equipment and procedures that will result in shotcrete in place meeting the requirements of this Specification. Determine operating procedures for placement in, extended distances, and around any obstructions where placement velocities and mix consistency shall be adjusted.
- B. Placement Techniques: Do not place shotcrete if drying or stiffening of the mix takes place at any time prior to delivery to the nozzle.
 1. Control thickness, method of support, air pressure, and water content of shotcrete to preclude sagging or sloughing off. Discontinue shotcreting or provide suitable means to screen the nozzle stream if wind or air currents cause separation of the nozzle stream during placement.
 2. Hold nozzle as perpendicular to surface as work will permit, to secure maximum compaction with minimum rebound.
 3. In shotcreting walls, begin application at bottom. Ensure work does not sag.
 4. Layering:
 - a. Build up layers by making several passes of nozzle over work area.
 - b. Broom or scarify the surface of freshly placed shotcrete to which, after hardening, additional layers of shotcrete are to be bonded. Dampen surface just prior to application of succeeding layers.
 - c. Allow each layer of shotcrete to take initial set before applying succeeding layers.

- d. Use radial templates to insure exact radii from flat bottom of Skate Park to face of coping. Template shall be fabricated from steel or 3/4" Plywood. Check every horizontal foot when applying shotcrete for conformance of intended wall radii. Brace template and place levels at arc to tangent connections to insure no kinks will be formed. Kinks at the bottom of bowls will not be acceptable. Slumping of the shotcrete causing coping setback will not be acceptable.
5. Placement Around Reinforcement:
- a. Hold the nozzle at such distance and angle to place materials behind reinforcement before any material is allowed to accumulate on its face. In the dry-mix process, additional water may be added to the mix when encasing reinforcement to facilitate a smooth flow of material behind the bars.
 - b. Test to ascertain if any void or sand pockets have developed around or behind reinforcement by probing with an awl or other pointed tool after the shotcrete has achieved its initial set, by removal of randomly selected bars, or coring or other suitable standards.
- C. Access: Allow easy access to shotcrete surfaces for screening and finishing, permitting uninterrupted application.
- 3.5 REMOVAL OF SURFACE DEFECTS IN CONCRETE
- A. General: Remove and replace shotcrete which lacks uniformity, exhibits segregation honeycombing, or lamination, or which contains any dry patches, slugs, voids, or pockets. Remove defective areas.
 - B. Sounding: Sound work with hammer for voids. Remove and replace damaged in-place Shotcrete.
- 3.6 CONCRETE FINISH
- A. Finish-General: Smooth form finish shall consist of a smooth, hard, uniform texture with a minimum of seams
 - I. Radial Wall Finish: Float finish on radial face of wall shall consist of a smooth, hard, uniform surface of smooth steel trowel. Level to a tolerance of 1/10" inch in 10 feet when tested with a 10-foot steel straightedge placed on the surface horizontally and vertically with radial template with the appropriate radii. Grinding the surfaces will not be an acceptable means of achieving the intended radii. Concrete finish work shall match the approved sample poured on site.
- 3.7 CONCRETE JOINTS
- A. Cleaning: The entire joint shall be thoroughly cleaned and wetted prior to the application of additional shotcrete.
 - B. Reinforcement: Make joints perpendicular to the main reinforcement. Continue reinforcement across joints.
- 3.8 CONCRETE CURING AND PROTECTION
- A. Curing Agent: Apply curing agent, blankets, or plastic after final finish is achieved. CONTRACTOR to remove cure agent at end of cure period and power wash all walls prior to final acceptance.
- 3.9 REJECTIONS
- A. Mock-Ups shall be completed to the satisfaction of the RESIDENT ENGINEER including aggregates, texture, color, and finishes. If mock-ups are rejected by the RESIDENT ENGINEER, the CONTRACTOR

in charge of the specific scope of work shall remove and replace mock up for the RESIDENT ENGINEER's approval at no additional cost to the CITY.

- B. If Mock-ups are damaged, removed, the CONTRACTOR in charge of the specific scope of work shall repair/replace in-kind immediately at no additional cost to the CITY.
- C. Major variations in the appearance of integral colored concrete compared to manufacturer's sample chip shall be rejected by the RESIDENT ENGINEER. The CONTRACTOR in charge of the specific scope of work shall remove and replace mock up for the RESIDENT ENGINEER's approval at no additional cost to the CITY.
- D. Defects in the shotcrete including lack of uniformity, exhibits segregation honeycombing, or lamination, or which contains any dry patches, slugs, voids, or pockets shall be rejected by the RESIDENT ENGINEER. The CONTRACTOR in charge of the specific scope of work shall remove and replace mock up for the RESIDENT ENGINEER'S approval at no additional cost to the CITY.
- E. Radial wall finishes shall consist of smooth, hard, uniform surface of smooth trowel with a level tolerance of 1/10" within 10 feet when tested with a 10-foot steel straightedge placed on the surface horizontally and vertically. Grinding the surfaces will not be an acceptable means of achieving the intended radii and uniformity shall be approved by the RESIDENT ENGINEER. If rejected, The CONTRACTOR in charge of the specific scope of work shall remove and replace mock up for the RESIDENT ENGINEER'S approval at no additional cost to the CITY.

3.10 CLEAN UP

- A. At completion of Work, remove concrete stains from adjacent work, including but not limited to dissimilar paving types, walls, columns, railing posts, light fixtures, plant materials, to satisfaction of the RESIDENT ENGINEER.
- B. Efflorescence: Remove efflorescence as soon as practical after it appears, as part of final cleaning.
- C. Use least aggressive cleaning techniques possible.
- D. Wear protective eye wear, gloves, and clothing suitable to work and as required by cleaner manufacturer.
- E. If proprietary cleaning agents are used, pre-wet wall, test cleaning agent on a small, inconspicuous area, and check effects prior to proceeding. Begin cleaning at the top and work down. Thoroughly rinse wall afterwards with clean water. Follow cleaner manufacturer's instructions.
- F. Do not use muriatic (hydrochloric) acid on colored concrete.

END OF SECTION 03 37 01

SECTION 03 39 01 – CONCRETE CURING FOR SKATEBOARD PARKS

PART 1 – GENERAL

1.1 SCOPE OF WORK

- A. Furnish materials, labor, transportation, services, and equipment necessary to install all Concrete Curing related to the skate park as indicated on scope of work contract and shown on drawings and as specified herein.
- B. Related Work:
 - 1. Section 03 11 01 – Concrete Formwork for Skateboard Parks
 - 2. Section 03 30 01 – Cast-In-Place Concrete for Skateboard Parks
 - 3. Section 03 33 51 – Concrete finish for Skateboard Parks
 - 4. Section 03 37 01 – Shotcrete for Skateboard Parks

1.2 REFERENCES

- A. Comply with the applicable reference specifications as specified in the GENERAL PROVISIONS and in accordance with applicable laws, codes and regulations required by the City of San Diego, CA. Comply with the current provisions of the following Codes and Standards:
- B. ASTM - American Society for Testing and Materials:
 - 1. ASTM C94 – Ready-Mixed Concrete.
 - 2. ASTM C150 – Portland Cement.
 - 3. ASTM C271 – Sheet Materials for Curing Concrete.
 - 4. ASTM C309 – Liquid Membrane-Forming Compounds for Curing Concrete.
 - 5. ASTM F2480 – Standard Guide for In-ground Concrete Skate Park.
- C. ACI – American Concrete Institute:
 - 1. ACI 301 – Specifications for Structural Concrete for Buildings.
 - 2. ACI 305 – Recommended Practice for Hot Weather Concreting.
 - 3. ACI 306 – Recommended Practice for Cold Weather Concreting.
 - 4. ACI 318 – Building Code Requirements for Reinforced Concrete.
- D. CBC – California Building Code

1.3 SUBMITTALS

- A. Submit samples and detailed technical data of products proposed for curing use for the RESIDENT ENGINEER'S approval.
- B. Submit certification that materials meet specification requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store materials in dry and protected locations and protect from damage.

1.5 SITE CONDITIONS

- A. Environmental Requirements: Protect concrete against extreme cold and heat, frost, rapid drying, and damage by rain.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Curing Compound: ASTM C 309, non-staining, all resin type, white-pigmented, compatible with color admixture (if applicable).
- B. Acceptable Product: Crystal Rez for natural gray concrete or approved equal, and Davis Integral Color compatible curing agent. Curing Compound Application Rate: 350 sq. ft./U.S. Gallon (12.5m sq./L).

PART 3 – EXECUTION / CONSTRUCTION

3.1 CURING

- A. Protect concrete surfaces against rapid drying. Keep sealed with cure agent for necessary amount of time to reach concrete strength and inhibit moisture loss after placing per manufacturer's recommendation.
- B. Apply to exposed surface of concrete as soon as manufacturer recommends with an airless sprayer.
- C. Apply to sides of concrete paving upon removal of form boards.
- D. Meet requirements of manufacturer's current printed application instructions.
- E. Uniformly apply 2 coats and apply the second coat at right angle to first coat.
- F. Apply compound to form a continuous, uniform, coherent film that will not check, crack, or peel.
- G. Do not apply to concrete that is still bleeding, or has a visible water sheen on the surface.
- H. Protect paving surfaces from foot traffic with scuff-proof paper.
- I. Immediately re-coat damaged areas of curing compound.
- J. Protect surface from water, adjacent shotcrete work and debris.

3.2 CLEANUP

- A. CONTRACTOR to remove all cure agent from concrete surface with power washing equipment and soft brush not causing abrasion to finish work surface prior to final inspection. No Cure Agent shall be present on any surfaces for final inspection acceptance. Remove debris and trash resulting from specified work.

END OF SECTION 03 39 01

SECTION 05 50 01 – METAL FABRICATIONS FOR SKATEBOARD PARKS

PART 1 – GENERAL

1.1 SCOPE OF WORK

- A. Furnish materials, labor, transportation, services, and equipment necessary to install all Metal Fabrications for the skate park as indicated on scope of work contract and shown on drawings and as specified herein.
- B. Custom Coping and Custom Metal Fabrication:
 - 1. The custom coping and custom metal fabrication consisting of rolling to specified radii (flat, gaining or losing elevation), cutting, piecing, sleeves, anchors, welding and setting to horizontal and vertical elevations is deemed sole source specialty work within the Contract Documents.
 - 2. All work related to the custom coping, metal fabrication and installation shall be coordinated with the RESIDENT ENGINEER, prior to project start.
 - 3. All custom fabricated steel coping and rails to be manufactured and supplied by **Raw Edge Steel**, (Available at Thompson Building Materials, Fontana, CA) or approved equal.
- C. Related Work:
 - 1. Section 03 11 01 – Concrete Formwork for Skateboard Parks
 - 2. Section 03 20 01 – Concrete Reinforcement for Skateboard Parks
 - 3. Section 03 30 01 – Cast-In-Place Concrete for Skateboard Parks
 - 4. Section 03 37 01 – Shotcrete for Skateboard Parks

1.2 REFERENCES

- A. Comply with the applicable reference specifications as specified in the GENERAL PROVISIONS and in accordance with applicable laws, codes and regulations required by the City of San Diego, CA. Comply with the current provisions of the following Codes and Standards:
- B. ASTM - American Society for Testing and Materials:
 - 1. ASTM A36 – Structural Steel.
 - 2. ASTM A120 – Steel Pipe and Tubing.
 - 3. ASTM F2480 – Standard Guide for In-ground Concrete Skate Park.
- C. CBC – California Building Code
- D. AWS – American Welding Society
 - 1. AWS D1.1 – Structural Welding Code (latest edition)
- E. CRSI – Concrete Reinforcing Steel Institute: “Manual of Standard Practice,” latest edition.
- F. AISC – American Institute of Steel Construction, Inc: “Specifications of Architecturally Exposed Structural Steel,” latest edition.

1.3 QUALITY ASSURANCE

- A. Qualifications of Fabricators: Experienced in fabrication of miscellaneous metals.
- B. Qualifications of Welders: Welding shall be done only by certified welding operators currently qualified according to AWS D1.1.

- C. Qualifications of Workmen: Provide at least one person who shall be present at all times during execution of this portion of the Work, and who shall be thoroughly familiar with the type of materials being installed, the referenced standards, the requirements of this Work, and who shall direct all work performed under this Section. Welds indicated may be made in shop or field with approval.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. CONTRACTOR shall submit shop drawings for all custom fabricated items under this section. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners and accessories. Indicate welded connections using standard AWS welding symbols.
 - 2. Verification: Verify all measurements at the job. Show dimensions, sizes, thicknesses, gauges, finishes, joining, attachments, and relationship of work to adjoining construction. Where items shall fit and coordinate with finished surfaces and/or constructed spaces, take measurements at site and not from drawings.
- B. Samples: Required for all Coping and Edging of concrete work. Submit finish metal samples for final finish selection. Submit prior to delivery to site. Attach name, address of manufacturer and/or supplier to each sample.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Storage of Materials: Materials which are stored at the project site shall be above ground on platforms, skids, or other supports. Protect steel from corrosion. Store other materials in a weather-tight and dry place until ready for use.
- B. Protection:
 - 1. Use all means necessary to protect miscellaneous metals before, during and after installation and to protect the installed work and materials of all other trades.
 - 2. Protect any adjacent materials or areas below from damage due to weld splatter or sparks during field welding.
- C. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the RESIDENT ENGINEER and at no additional cost to the CITY.

1.6 JOB CONDITIONS

- A. Examine existing conditions in which the work is to be installed. Notify RESIDENT ENGINEER if conditions are unacceptable to begin work.
- B. Do not proceed with the work until unsatisfactory conditions have been corrected.

1.7 COORDINATION

- A. Templates and Built-ins: Furnish all anchors, fastenings, sleeves, setting templates and layouts affecting or installed in the work of other trades.
- B. Delivery: Where items shall be incorporated or built into adjacent work, deliver to trade responsible for such work in sufficient time that progress of work is not delayed. Be responsible for proper location of such items.
- C. Coordination: Coordinate with work of Cast-In-Place Concrete for skateboard parks.

1.8 JOB SITE SAMPLE

- A. CONTRACTOR to provide fabricated, onsite sample of metal item(s), complete with approved finish, for review by the RESIDENT ENGINEER before fabrication of total quantities. Any fabrication of project item(s) by CONTRACTOR before RESIDENT ENGINEER review and approval is subject to rejection.
- B. Approved sample(s) shall be used as the standard of workmanship and shall remain on site until work has been completed and approved by the RESIDENT ENGINEER.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. 2" ROUND STEEL PIPE COPING / RAIL: HSS 2.375 O.D. X 2.067" I.D. X 0.154", Schedule 40.
 - B. 2" X 6" RECTANGULAR STEEL TUBE RAIL: HSS 2.000 X 6.000 X 0.188, ASTM A-500.
 - C. 4" X 2" RECTANGULAR STEEL TUBE RAIL: HSS 4.000 X 2.000 X 0.188, ASTM A-500.
 - D. 4" X 4" BENT PLATE COPING: HSS 4.000 X 4.000 X 0.2500, ASTM A-36, Hot Rolled Steel.
 - E. 6" STEEL C-CHANNEL: HSS 6.000 X 1.920 X 0.200, ASTM A-36, Hot Rolled Steel.
 - F. 6" STEEL FLAT PLATE: HSS 6.000 X 0.125, ASTM A-36, Hot Rolled Steel plate.
 - G. 1/2" THICK STEEL FLAT PLATE: HSS 0.500, ASTM A-36, Hot Rolled Steel plate. Length and width varies per plan)
 - H. WELDING RODS: E-70 series low hydrogen unless otherwise noted on drawings.
- 2.2 GROUT: Non-shrinking Master Builder's "Embedco", Conrad Sovig's "Metel-Mxs Grout", Sonneborn's "Ferrolith G Redi-Mixed Grout" or approved equal.
- 2.3 OTHER MATERIALS: All other materials, not specifically described but required for a complete and proper installation of miscellaneous metals, shall be new, first quality of their respective kinds and subject to the approval of RESIDENT ENGINEER.

PART 3 - EXECUTION

3.1 EXISTING CONDITIONS

- A. Inspection: Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
- B. Discrepancies: In the event of a design discrepancy, immediately notify the RESIDENT ENGINEER.

3.2 COORDINATION

- A. General: Carefully coordinate with all other trades to insure proper and adequate interface of the work of other trades with the Work of this Section.

- B. Delivery: Insure timely delivery of all metal fabrications which shall be installed in other work so as not to delay that work.

3.3 INSTALLATION

A. General:

1. Install metal fabrications in strict accordance with the Drawings, the approved Shop Drawings, and all applicable codes, regulations and standards.
2. Obtain RESIDENT ENGINEER review prior to site cutting or making adjustment which are not parts of the scheduled work.
3. Install items square and level, accurately fitted and free from distortion or defects.
4. Align all metal fabrications as shown on the Drawings, and where vertical or horizontal members are shown. Align them straight, plumb and level within tolerance.
5. Make provisions for erection stresses by temporary bracing. Keep work in alignment.
6. Replace items damaged in course of installation.
7. Perform field welding in accordance with AWS D1.1
8. After installation, grind smooth and touch-up field welds.

3.4 WORKMANSHIP

- A. Layout: Set all work plumb, true, rigid, and neatly trimmed out. Miter corners and angles of exposed molding and frames unless otherwise noted.
- B. Fitting: Fit exposed connections accurately together to form tight hairline joints.
- C. Labor: Employ only workmen specifically skilled in such work.

3.5 FABRICATION

- A. Shop assemble in largest practicable dimensions, making members true to length so assembling may be done without fillers.
- B. Provide all surfaces free of file marks, dents, hammer marks, wire edges or any unsightly surface defects.
- C. STEEL PIPE COPING: Roll pipe to conform with top radius curve of each bowl and ledge as shown on drawings. Refer to drawing details for relational tolerance to concrete surface and other steel.

3.6 ATTACHMENTS AND REINFORCEMENTS

- A. Do all cutting, shearing, drilling, punching, threading, tapping, etc., required for site metalwork or for attachment of adjacent work. If applicable, drill or punch holes; do not use cutting torch.

- 3.7 OTHER CONNECTORS: Make all permanent connections in ferrous metal surfaces using welds where at all possible; do not use bolts or screws.

3.8 WELDING

- A. Preparation: Remove all rust, paint, scale and other foreign matter. Wire brush all flame-cut edges. Clamp members as required and alternate welds, all as necessary to prevent warping or misalignment.
- C. Exposed Welds: Uniformly grind smooth (no tolerance) all welds normally exposed to view and feel in the finished work.

- D. Faulty and Defective Welding: Chip out and replace all welding showing cracks, slag inclusion, lack of fusion, bad undercut or other defects ascertained by visual or other means of inspection. Replace and re-weld at no cost to CITY.

- E. Field Welding:

- 1. Procedure: Comply with AWS code of manual shielded metal-arc welding, appearance and quality of welds made, and methods used in correcting welding work.
- 2. Protection: Protect all adjacent surfaces from damage due to weld sparks, spatter, or tramp metal.

3.9 SURFACE TREATMENT AND PROTECTIVE COATINGS

- A. Cleaning:

- 1. Thoroughly clean all mill scale, rust, dirt, grease and other foreign matter from ferrous metal prior to any galvanizing, or painting.
- 2. Conditions which are too severe to be removed by hand cleaning, shall be cleaned using appropriate methods for solvent cleaning, power tool cleaning and brush-off blast cleaning.

- B. Exterior Ferrous Metal:

- 1. Grind smooth all welds, burrs, and rough surfaces. Clean all coping from grease.
- 2. Shop coat iron metal items; using anti-rust primer.
- 3. All welds to be painted with primer after appropriate connections and grinding has taken place. Touch-up all scratched primer prior to shotcrete application.

3.10 REJECTIONS

- A. Exposed Welds: Uniformly grind smooth (no tolerance) all welds normally exposed to view and feel in the finished work. Grinds are to be reviewed by the RESIDENT ENGINEER, if rejected the contractor shall re-weld and regrind at no additional cost to the CITY for the RESIDENT ENGINEER'S approval.
- B. Faulty and Defective Welding: Chip out and replace all welding showing cracks, slag inclusion, lack of fusion, bad undercut or other defects ascertained by visual or other means of inspection by the RESIDENT ENGINEER. If rejected, the contractor shall replace and re-weld at no additional cost to CITY for the RESIDENT ENGINEER'S approval.

3.11 CLEAN-UP

- A. Keep all areas of work clean, neat and orderly at all times. Keep paved areas clean during installation.
- B. Clean up and remove all debris from the entire work area prior to Final Acceptance to satisfaction of RESIDENT ENGINEER.

END OF SECTION 05 51 01

SECTION 09 91 01 – PAINTING FOR SKATEBOARD PARKS

PART 1 – GENERAL

1.1 SCOPE OF WORK

- A. Furnish materials, labor, transportation, services, and equipment necessary to install all Painting for the skate park as indicated on scope of work contract and shown on drawings and as specified herein.
- B. This Section includes surface preparation and field painting of the following:
 - 1. Miscellaneous exposed exterior items and surfaces.
- C. Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, RESIDENT ENGINEER AND SKATE PARK CONSULTANT shall select from standard colors and finishes available.
 - 1. Painting includes field painting of exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.
- D. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
 - 1. Finished metal surfaces include the following if used:
 - a. Stainless steel.
 - b. Bronze and brass.
 - c. Iron
 - 2. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.
- B. Related Work:
 - 1. Section 05 50 01 – Metal Fabrications for Skateboard Parks

1.2 REFERENCES

- A. Comply with the applicable reference specifications as specified in the GENERAL PROVISIONS and in accordance with applicable laws, codes and regulations required by the City of San Diego, CA. Comply with the current provisions of the following Codes and Standards:
- B. ASTM - American Society for Testing and Materials
- C. CBC – California Building Code
- D. SSPC – Society for Protective Coatings: “Steel Structures Painting Manual,” latest edition.

1.3 DEFINITIONS

- A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
 - 1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
 - 2. Eggshell refers to low-sheen finish with a gloss range between 5 and 20 when measured at a 60-degree meter.
 - 3. Satin refers to low-sheen finish with a gloss range between 15 and 35 when measured at a 60-degree meter.

4. Semigloss refers to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter.
5. Full gloss refers to high-sheen finish with a gloss range more than 65 when measured at a 60-degree meter.

1.4 SUBMITTALS

- A. Product Data: For each paint system specified. Include block fillers and primers.
 1. Material List: Provide an inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
 2. Manufacturer's Information: Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.
 3. Certification by the manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).
- B. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for each type of finish-coat material indicated.
 1. After color selection, CONTRACTOR will furnish color chips for surfaces to be coated.
- C. Samples for Verification: Of each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.
 1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.
 2. Provide a list of materials and applications for each coat of each sample. Label each sample for location and application.
 3. Submit Samples on the following substrates for CAIFORNI SKATEPARKS / SKATE PARK DESIGNER review of color and texture only:
 - a. Ferrous Metal: Provide two 4-inch- (100-mm-) square samples of flat metal and two 8-inch- (200-mm-) long samples of solid metal for each color and finish.

1.5 QUALITY ASSURANCE

- A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to that indicated for this Project with a record of successful in-service performance.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:
 1. Product name or title of material.
 2. Product description (generic classification or binder type).
 3. Manufacturer's stock number and date of manufacture.
 4. Contents by volume, for pigment and vehicle constituents.
 5. Thinning instructions.
 6. Application instructions.
 7. Color name and number.
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain containers used in storage in a clean condition, free of foreign materials and residue.

- C. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.7 PROJECT CONDITIONS

- A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 and 90 deg F (10 and 32 deg C).
- B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 and 95 deg F (7.2 and 35 deg C).
- C. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in the paint schedules.

2.2 MATERIALS

- A. Material Compatibility: Provide fillers, primers, undercoats, and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
 - 1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.
- C. Color for Skate Park Rails & Metal/Coping Protection:
Provide color selections made by the RESIDENT ENGINEER and SKATEPARK ARCHITECT.

PART 3 – EXECUTION / CONSTRUCTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with the Applicator present, under which painting will be performed for compliance with paint application requirements.
 - 1. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
 - 2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.
- B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify the RESIDENT ENGINEER about anticipated problems using the materials specified over substrates primed by others.

3.2 PREPARATION

- A. General: Remove hardware and hardware accessories, plates, machined surfaces, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting.
 1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
- B. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning.
 1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
- C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
 1. Provide barrier coats over incompatible primers or remove and reprime.
 2. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
 - a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
 3. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with the Steel Structures Painting Council's (SSPC) recommendations.
 - a. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with the same primer as the shop coat.
- D. Materials Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
 1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
 2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
 3. Use only thinners approved by paint manufacturer and only within recommended limits.

3.3 APPLICATION

- A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
 1. Paint colors, surface treatments, and finishes are indicated in the schedules.
 2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
 3. Provide finish coats that are compatible with primers used.
 4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, covers, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
 5. Sand lightly between each succeeding enamel or varnish coat.
- B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
 1. The number of coats and the film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.

2. Omit primer on metal surfaces that have been shop primed and touchup painted.
 3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
 4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.
- C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
1. Brushes: Use brushes best suited for the type of material applied. Use brush of appropriate size for the surface or item being painted.
 2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.
 3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.
- D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.
- E. Fillers: Apply fillers at a rate to ensure complete coverage of pores filled.
- F. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.
- G. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
- H. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.4 CLEANING

- A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.
- B. After completing painting, clean paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

3.5 PROTECTION

- A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by the RESIDENT ENGINEER.
- B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
 1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.6 EXTERIOR PAINT SCHEDULE

- A. Ferrous Metal: Provide the following finish systems over exterior ferrous metal. Primer is not required on shop-primed items.
1. Semigloss, Acrylic-Enamel Finish: 2 finish coats over a rust-inhibitive primer.
 - a. Primer: Rust-inhibitive metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mils (0.033 mm).
 - 1) Dura Clad 55 High Solids Universal Alkyd Primer by Duron.
 - 2) 433 RustPlate Rust Inhibitive Primer by Kurfees Coating.
 - 3) Fuller: 621-04 Blox-Rust Alkyd Metal Primer.
 - 4) Glidden: 5205 Glid-Guard Tank & Structural Primer, Red.
 - 5) Moore: IronClad Retardo Rust-Inhibitive Paint #163.
 - 6) PPG: 6-208 Speedhide Interior/Exterior Rust Inhibitive Steel Primer.
 - 7) P & L: S/D 1009 Suprime "9" Interior/Exterior Alkyd Metal Primer.
 - b. First and Second Coats: Semigloss, exterior, acrylic-latex enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils (0.066 mm).
 - 1) Devoe: 17XX Wonder-Shield Semi-Gloss Exterior Acrylic Latex House and Trim Paint.
 - 2) Fuller: 664-XX Weather King II Semi-Gloss House & Trim Paint.
 - 3) Glidden: 6600 Series Spred Ultra Exterior Gloss Latex House & Trim Paint.
 - 4) Moore: MoorGlo Latex House & Trim Paint #096.
 - 5) PPG: 78 Line Sun-Proof Semi-Gloss Acrylic Latex House and Trim Paint.
 - 6) P & L: Z/F 3100 Series Aqua Royal Latex House & Trim Finish.

END OF SECTION 09 91 01

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 2000 V and less.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Product Schedule: Indicate type, use, location, and termination locations.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer's authorized service representative.
- B. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA.
 - 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Alpha Wire Company.
 - 2. American Bare Conductor.

3. Belden Inc.
4. Cerro Wire LLC.
5. Encore Wire Corporation.
6. General Cable Technologies Corporation.
7. Service Wire Co.
8. Southwire Company.

- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Conductors: Copper, complying with NEMA WC 70/ICEA S-95-658.
1. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN/THWN-2.

2.2 CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. 3M Electrical Products.
 2. AFC Cable Systems; a part of Atkore International.
 3. Gardner Bender.
 4. Hubbell Power Systems, Inc.
 5. Ideal Industries, Inc.
 6. ILSCO.
 7. NSi Industries LLC.
 8. O-Z/Gedney; a brand of Emerson Industrial Automation.
 9. Service Wire Co.
 10. TE Connectivity Ltd.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Feeders: Copper for feeders smaller than No. 4 AWG; copper or aluminum for feeders No. 4 AWG and larger. Conductors shall be solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

- C. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
 - D. Branch Circuits: Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.
- 3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS
- A. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.
 - B. Branch Circuits Concealed in Ceilings, Bridge Structure: Type THHN/THWN-2, single conductors in raceway.
 - C. Branch Circuits Concealed Underground: Type THHN/THWN-2, single conductors in raceway.
- 3.3 INSTALLATION OF CONDUCTORS AND CABLES
- A. Conceal cables underground in finished walls, ceilings, and under bridge structures unless otherwise indicated.
 - B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
 - C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
 - D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
 - E. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."
- 3.4 CONNECTIONS
- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
 - B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
 - 1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.
 - C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Perform each of the following visual and electrical tests:
 - a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
 - b. Test bolted connections for high resistance using one of the following:
 - 1) A low-resistance ohmmeter.
 - 2) Calibrated torque wrench.
 - c. Inspect compression applied connectors for correct cable match and indentation.
 - d. Inspect for correct identification.
 - e. Inspect cable jacket and condition.
 - f. Insulation-resistance test on each conductor with respect to ground and adjacent conductors. Apply a potential of 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable for a one-minute duration.
 - g. Continuity test on each conductor and cable.
 - h. Uniform resistance of parallel conductors.
- C. Cables will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports to record the following:
 - 1. Procedures used.
 - 2. Results that comply with requirements.
 - 3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

END OF SECTION 260519

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

- A. Section includes grounding and bonding systems and equipment.
- B. Section includes grounding and bonding systems and equipment, plus the following special applications:
 - 1. Underground distribution grounding.
 - 2. Foundation steel electrodes.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. As-Built Data: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:
 - 1. Ground rods.
- B. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Burndy; Part of Hubbell Electrical Systems.
2. Dossert; AFL Telecommunications LLC.
3. ERICO International Corporation.
4. Fushi Copperweld Inc.

2.2 SYSTEM DESCRIPTION

- A. Comply with UL 467 for grounding and bonding materials and equipment.

2.3 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 1. Solid Conductors: ASTM B 3.
 2. Stranded Conductors: ASTM B 8.
 3. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.4 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.5 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet (19 mm by 3 m).

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Conductor Terminations and Connections:
 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.

2. **Underground Connections:** Welded connectors except at test wells and as otherwise indicated.
3. **Connections to Ground Rods at Test Wells:** Bolted connectors.
4. **Connections to Structural Steel:** Welded connectors.

3.2 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.
- B. **Grounding Handholes:** Install a driven ground rod through handhole floor, per drawing detail.

3.3 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 1. Feeders and branch circuits.
 2. Lighting circuits.
 3. Receptacle circuits.
 4. Single-phase motor and appliance branch circuits.
 5. Three-phase motor and appliance branch circuits.
 6. Flexible raceway runs.
- C. **Poles Supporting Outdoor Lighting Fixtures:** Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.
- D. **Metallic Fences:** Comply with requirements of IEEE C2.
 1. **Grounding Conductor:** Bare copper, not less than No. 8 AWG.
 2. **Gates:** Shall be bonded to the grounding conductor with a flexible bonding jumper.
 3. **Barbed Wire:** Strands shall be bonded to the grounding conductor.

3.4 INSTALLATION

- A. **Grounding Conductors:** Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. **Ground Rods:** Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.
 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.

- C. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Section 260543 "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches (300 mm) deep, with cover.
 - 1. Test Wells: Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.
- D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
 - 1. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
 - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 - 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
 - 3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at individual ground rods. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method according to IEEE 81.
- C. Grounding system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Resident Engineer promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Construction requirements for concrete bases.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
 - a. Hangers.
 - b. Steel slotted support systems.
 - c. Nonmetallic support systems.
 - d. Trapeze hangers.
 - e. Clamps.
 - f. Eye nuts.
 - g. Saddles.
 - h. Brackets.
 - 2. Include rated capacities and furnished specialties and accessories.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Pedestrian bridge and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Structural members to which hangers and supports will be attached.
 - 2. Items mounted to pedestrian bridge.
- B. Seismic Qualification Certificates: For hangers and supports for electrical equipment and systems, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

C. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 1. AWS D1.1/D1.1M.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Hangers and supports shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 1. The term "withstand" means "the supported equipment and systems will remain in place without separation of any parts when subjected to the seismic forces specified."
 2. Component Importance Factor: 1.5.
- B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 1. Flame Rating: Class 1.
 2. Self-extinguishing according to ASTM D 635.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4 factory-fabricated components for field assembly.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit, a part of Atkore International.
 - b. B-line, an Eaton business.
 - c. ERICO International Corporation.
 - d. Flex-Strut Inc.
 2. Material: Galvanized steel.
 3. Channel Width: 1-1/4 inches (31.75 mm).

4. **Metallic Coatings:** Hot-dip galvanized after fabrication and applied according to MFMA-4.
 5. **Nonmetallic Coatings:** Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 6. **Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.**
 7. **Channel Dimensions:** Selected for applicable load criteria.
- B. **Conduit and Cable Support Devices:** Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- C. **Support for Conductors in Vertical Conduit:** Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.
- D. **Structural Steel for Fabricated Supports and Restraints:** ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.
- E. **Mounting, Anchoring, and Attachment Components:** Items for fastening electrical items or their supports to pedestrian bridge surfaces include the following:
1. **Powder-Actuated Fasteners:** Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - 1) Hilti, Inc.
 - 2) ITW Ramset/Red Head; Illinois Tool Works, Inc.
 - 3) MKT Fastening, LLC.
 2. **Mechanical-Expansion Anchors:** Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - 1) B-line, an Eaton business.
 - 2) Empire Tool and Manufacturing Co., Inc.
 - 3) Hilti, Inc.
 - 4) ITW Ramset/Red Head; Illinois Tool Works, Inc.
 3. **Concrete Inserts:** Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
 4. **Clamps for Attachment to Steel Structural Elements:** MSS SP-58 units are suitable for attached structural element.

5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems unless requirements in this Section are stricter.
- B. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for RMCs as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, RMCs may be supported by openings through structure members, according to NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to pedestrian bridge structural elements by the following methods unless otherwise indicated by code:
 1. To New Concrete: Bolt to concrete inserts.
 2. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 3. To Existing Concrete: Expansion anchor fasteners.
 4. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm)

thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.

5. To Steel: With lock washers and nuts, Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033000 "Cast-in-Place Concrete."
- C. Anchor equipment to concrete base as follows:
 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 26 05 33 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Boxes, enclosures, and cabinets.
4. Handholes and boxes for exterior underground cabling.

- B. Related Requirements:

1. Section 260543 "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.

1.3 DEFINITIONS

- A. GRC: Galvanized rigid steel conduit.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of conduit groups with common supports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems; a part of Atkore International.
2. Allied Tube & Conduit; a part of Atkore International.
3. Anamet Electrical, Inc.

4. Calconduit.

- B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. GRC: Comply with ANSI C80.1 and UL 6.
- D. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
 - 1. Comply with NEMA RN 1.
 - 2. Coating Thickness: 0.040 inch (1 mm), minimum.
- E. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- F. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
 - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
 - 2. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
 - 3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.
- G. Joint Compound for GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AFC Cable Systems; a part of Atkore International.
 - 2. Anamet Electrical, Inc.
 - 3. Arnco Corporation.
 - 4. CANTEX INC.
- B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. ENT: Comply with NEMA TC 13 and UL 1653.
- D. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- E. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

- F. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Adalet.
2. Crouse-Hinds, an Eaton business.
3. EGS/Appleton Electric.
4. Erickson Electrical Equipment Company.

- B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

- C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

- D. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.

- E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

- F. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep).

- G. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 3R with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

- H. Cabinets:

1. NEMA 250, Type 3R galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Pad lockable door.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

2.4 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

- A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.5 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

- A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
1. Tests of materials shall be performed by an independent testing agency.
 2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed Conduit: GRC.
 2. Concealed Conduit, Aboveground: GRC.
 3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
 4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Minimum Raceway Size: 3/4-inch (21-mm) trade size.
- C. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- D. Install surface raceways only where indicated on Drawings.
- E. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C).

3.2 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.

- D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- E. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.
- G. Conceal conduit and paint with the same color as pedestrian bridge unless otherwise indicated. Install conduits at underside of pedestrian bridge parallel or perpendicular to pedestrian bridge structural members.
- H. Support conduit within 12 inches ((300 mm)) of enclosures to which attached.
- I. Stub-ups to Above Grade:
 - 1. Use RMC for raceways.
 - 2. Use a conduit threaded cap to terminate stub-ups not terminated in hubs or in an enclosure.
- J. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- K. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- L. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- N. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- O. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- P. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- Q. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

- R. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.
- S. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
1. Where an underground service raceway enters a pedestrian bridge structure.
 2. Where otherwise required by NFPA 70.
- T. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- U. Expansion-Joint Fittings:
1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C) and that has straight-run length that exceeds 25 feet (7.6 m). Install in each run of aboveground RMC conduit that is located where environmental temperature change may exceed 100 deg F (55 deg C) and that has straight-run length that exceeds 100 feet (30 m).
 2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
 3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.00078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) of temperature change for metal conduits.
 4. Install expansion fittings at all locations where conduits cross pedestrian bridge structure expansion joints.
 5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- V. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for recessed and semi recessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
1. Use LFMC in damp or wet locations subject to severe physical damage.
 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- W. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to bottom of box unless otherwise indicated.

- X. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- Y. Fasten junction and pull boxes to or support from pedestrian bridge structure. Do not support boxes by conduits.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches (150 mm) in nominal diameter.
2. Install backfill as specified in Section 312000 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at through underside of pedestrian bridge floor.
 - a. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
6. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.
- D. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm

lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.

- E. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

SECTION 26 05 43 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Direct-buried conduit, ducts, and duct accessories.
 - 2. Handholes and boxes.

1.3 DEFINITIONS

- A. Trafficways: Locations where vehicular or pedestrian traffic is a normal course of events.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include duct-bank materials, including separators and miscellaneous components.
 - 2. Include ducts and conduits and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
 - 3. Include accessories for handholes.
 - 4. Include warning tape.

1.5 INFORMATIONAL SUBMITTALS

- A. Duct-Bank Coordination Drawings: Show duct profiles and coordination with other utilities and underground structures.
 - 1. Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.
- B. Product Certificates: For concrete and steel used in precast concrete handholes, as required by ASTM C 858.
- C. Qualification Data: For professional engineer and testing agency responsible for testing nonconcrete handholes and boxes.
- D. Source quality-control reports.

- E. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

1.7 FIELD CONDITIONS

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by the City or others unless permitted under the following conditions, and then only after arranging to provide temporary electrical service according to requirements indicated:
 - 1. Notify the City no fewer than 5 days in advance of proposed interruption of electrical service.
 - 2. Do not proceed with interruption of electrical service without the Resident Engineer's written permission.
- B. Ground Water: Assume ground-water level is 36 inches (900 mm) below ground surface unless a higher water table is noted on Drawings.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR DUCTS AND RACEWAYS

- A. Comply with ANSI C2.

2.2 CONDUIT

- A. Rigid Steel Conduit: Galvanized. Comply with ANSI C80.1.
- B. RNC: NEMA TC 2, Type EPC-40-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

2.3 NONMETALLIC DUCTS AND DUCT ACCESSORIES

- A. Solvents and Adhesives: As recommended by conduit manufacturer.
- B. Duct Accessories:
 - 1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and size of ducts with which used, and selected to provide minimum duct spacing indicated while supporting ducts during concreting or backfilling.
 - 2. Warning Tape: Underground-line warning tape specified in Section 260553 "Identification for Electrical Systems."

2.4 PRECAST CONCRETE HANDHOLES AND BOXES

- A. Comply with ASTM C 858 for design and manufacturing processes.
- B. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have load rating consistent with that of handhole or box.
 - 1. Frame and Cover: Weatherproof steel frame, with steel cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
 - 2. Cover Legend: Molded lettering, "LIGHTING."
 - 3. Configuration: Units shall be designed for flush burial and have integral closed bottom unless otherwise indicated.
 - 4. Extensions and Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.
 - a. Extension shall provide increased depth of 12 inches (300 mm).
 - b. Slab: Same dimensions as bottom of enclosure, and arranged to provide closure.
 - 5. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.
 - 6. Windows: Precast openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks, plus an additional 12 inches (300 mm) vertically and horizontally to accommodate alignment variations.
 - a. Windows shall be located no less than 6 inches (150 mm) from interior surfaces of walls, floors, or frames and covers of handholes, but close enough to corners to facilitate racking of cables on walls.
 - b. Window opening shall have cast-in-place, welded-wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.
 - c. Window openings shall be framed with at least two additional No. 3 steel reinforcing bars in concrete around each opening.
 - 7. Duct Entrances in Handhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
 - a. Type and size shall match fittings to duct or conduit to be terminated.
 - b. Fittings shall align with elevations of approaching ducts and be located near interior corners of handholes to facilitate racking of cable.
 - 8. Handholes 12 inches wide by 24 inches long (300 mm wide by 600 mm long) and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.
- C. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate layout and installation of ducts, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field. Notify Resident Engineer if there is a conflict between areas of excavation and existing structures or archaeological sites to remain.
- B. Coordinate elevations of ducts and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of ducts and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct runs drain to manholes and handholes, and as approved by Resident Engineer.
- C. Clear and grub vegetation to be removed, and protect vegetation to remain according to Section 700 of the White Book. Remove and stockpile topsoil for reapplication according to Section 700 of the White Book.

3.2 UNDERGROUND DUCT APPLICATION

- A. Ducts for Electrical Feeders 600 V and Less: RNC, NEMA Type EPC-40-PVC, in direct-buried duct bank unless otherwise indicated.
- B. Ducts for Electrical Branch Circuits: RNC, NEMA Type EPC-40-PVC, in direct-buried duct bank unless otherwise indicated.

3.3 EARTHWORK

- A. Excavation and Backfill: Comply with Section 700 of the White Book, but do not use heavy-duty, hydraulic-operated, compaction equipment.
- B. Restore surface features at areas disturbed by excavation, and re-establish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed.
- C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary top soiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Section 212 of the White Book "Turf and Grasses" and "Plants."
- D. Cut and patch existing pavement in the path of underground ducts and utility structures.

3.4 DUCT INSTALLATION

- A. Install ducts according to NEMA TCB 2.
- B. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes, to drain in both directions.

- C. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches (1200 mm), both horizontally and vertically, at other locations unless otherwise indicated.
- D. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.
- E. Installation Adjacent to High-Temperature Steam Lines: Where duct banks are installed parallel to underground steam lines, perform calculations showing the duct bank will not be subject to environmental temperatures above 40 deg C. Where environmental temperatures are calculated to rise above 40 deg C, and anywhere the duct bank crosses above an underground steam line, install insulation blankets listed for direct burial to isolate the duct bank from the steam line.
- F. Duct Entrances to Concrete Handholes: Use end bells, spaced approximately 10 inches (250 mm) o.c. for 5-inch (125-mm) ducts, and vary proportionately for other duct sizes.
 - 1. Begin change from regular spacing to end-bell spacing 10 feet (3 m) from the end bell without reducing duct line slope and without forming a trap in the line.
 - 2. Direct-Buried Duct Banks: Install an expansion and deflection fitting in each conduit in the area of disturbed earth adjacent to manhole or handhole. Install an expansion fitting near the center of all straight line direct-buried duct banks with calculated expansion of more than 3/4 inch (19 mm).
 - 3. Grout end bells into structure walls from both sides to provide watertight entrances.
- G. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig (1.03-MPa) hydrostatic pressure.
- H. Pulling Cord: Install 100-lbf- (445-N-) test nylon cord in empty ducts.
- I. Direct-Buried Duct Banks:
 - 1. Excavate trench bottom to provide firm and uniform support for duct bank. Comply with requirements in 700 of the White Book for preparation of trench bottoms for pipes less than 6 inches (150 mm) in nominal diameter.
 - 2. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
 - 3. Space separators close enough to prevent sagging and deforming of ducts, with not less than five spacers per 20 feet (6 m) of duct. Secure separators to earth and to ducts to prevent displacement during backfill and yet permit linear duct movement due to expansion and contraction as temperature changes. Stagger spacers approximately 6 inches (150 mm) between tiers.
 - 4. Depth: Install top of duct bank at least 36 inches (900 mm) below finished grade unless otherwise indicated.
 - 5. Set elevation of bottom of duct bank below frost line.
 - 6. Install ducts with a minimum of 3 inches (75 mm) between ducts for like services and 6 inches (150 mm) between power and signal ducts.
 - 7. Elbows: Install manufactured duct elbows for stub-ups at poles and equipment, at building entrances through floor, and at changes of direction in duct run unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.

8. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment, at bridge structure, and at changes of direction in duct run.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete.
 - b. For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
9. After installing first tier of ducts, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand place backfill to 4 inches (100 mm) over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction. Comply with requirements in 700 of the White Book for installation of backfill materials.
 - a. Place minimum 3 inches (75 mm) of sand as a bed for duct bank. Place sand to a minimum of 6 inches (150 mm) above top level of duct bank.
 - b. Place minimum 6 inches (150 mm) of engineered fill above concrete encasement of duct bank.
- J. Warning Planks: Bury warning planks approximately 12 inches (300 mm) above direct-buried ducts and duct banks, placing them 24 inches (600 mm) o.c. Align planks along the width and along the centerline of duct bank. Provide an additional plank for each 12-inch (300-mm) increment of duct-bank width over a nominal 18 inches (450 mm). Space additional planks 12 inches (300 mm) apart, horizontally.
- K. Warning Tape: Bury warning tape approximately 12 inches (300 mm) above all concrete-encased ducts and duct banks. Align tape parallel to and within 3 inches (75 mm) of centerline of duct bank. Provide an additional warning tape for each 12-inch (300-mm) increment of duct-bank width over a nominal 18 inches (450 mm). Space additional tapes 12 inches (300 mm) apart, horizontally.

3.5 INSTALLATION OF CONCRETE, HANDHOLES, AND BOXES

A. Precast Concrete Handhole Installation:

1. Comply with ASTM C 891 unless otherwise indicated.
2. Install units level and plumb and with orientation and depth coordinated with connecting ducts, to minimize bends and deflections required for proper entrances.
3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch (25-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.

B. Elevations:

1. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes 1 inch (25 mm) above finished grade.

2. Where indicated, cast handhole cover frame integrally with handhole structure.

3.6 GROUNDING

- A. Ground underground ducts according to Section 260526 "Grounding and Bonding for Electrical Systems."

3.7 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections and prepare test reports:
 1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts.
 2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide a minimum 6-inch- (150-mm-) long mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.
 3. Test handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Correct deficiencies and retest as specified above to demonstrate compliance.

3.8 CLEANING

- A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

END OF SECTION 260543

SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Identification for raceways.
 - 2. Identification for conductors.
 - 3. Underground-line warning tape.
 - 4. Warning labels and signs.
 - 5. Equipment identification labels, including arc-flash warning labels.
 - 6. Miscellaneous identification products.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.
- B. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with ASME A13.1 and IEEE C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

2.2 COLOR AND LEGEND REQUIREMENTS

- A. Raceways and Cables Carrying Circuits at 600 V or Less:
 - 1. Black letters on an orange field.
 - 2. Legend: Indicate voltage and system.
- B. Warning labels and signs shall include, but are not limited to, the following legends:
 - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
 - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

2.3 EQUIPMENT IDENTIFICATION LABELS

- A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with black letters on a white background. Minimum letter height shall be 3/8 inch (10 mm).
- B. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. Black letters on a white background. Minimum letter height shall be 3/8 inch (10 mm).

2.4 LABELS

- A. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

2.5 TAPES AND STENCILS:

- A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide; compounded for outdoor use.
- C. Underground-Line Warning Tape
 - 1. Tape:
 - a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical utility lines.
 - b. Printing on tape shall be permanent and shall not be damaged by burial operations.
 - c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.
 - 2. Color and Printing:
 - a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.

- b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE".

2.6 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Verify identity of each item before installing identification products.
- C. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- D. Apply identification devices to surfaces that require finish after completing finish work.
- E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- F. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.
- G. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches (400 mm) overall.

3.3 IDENTIFICATION SCHEDULE

- A. Concealed Raceways, Duct Banks, More Than 600 V, within Buildings: Tape and stencil 4-inch- (100-mm-) wide black stripes on 10-inch (250-mm) centers over orange background that extends full length of raceway or duct and is 12 inches (300 mm) wide. Stencil legend "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch- (75-mm-) high black letters on 20-inch (500-mm) centers. Stop stripes at legends. Retain one or both of first two

paragraphs below. Delete both for existing systems and replace with the existing identification scheme. Paragraphs contain requirements exceeding those in NFPA 70.

- B. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, and handholes, use color-coding conductor tape to identify the phase.
1. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded feeder and branch-circuit conductors.
 - a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
 - b. Colors for 208/120-V Circuits:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - c. Colors for 480/277-V Circuits:
 - 1) Phase A: Brown.
 - 2) Phase B: Orange.
 - 3) Phase C: Yellow.
 - d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- C. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive vinyl labels with the conductor or cable designation, origin, and destination.
- D. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 2. Use system of marker-tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- E. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, and control wiring cable.
1. Install underground-line warning tape for direct-buried cables and cables in raceways.
- F. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual. Apply labels to disconnect switches and protection equipment, control panels. Systems include

power, lighting, control, communication, signal, monitoring, and alarm unless equipment is provided with its own identification.

1. Labeling Instructions:

- a. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
- b. Unless labels are provided with self-adhesive means of attachment, fasten them with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment To Be Labeled:

- a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of an engraved, laminated acrylic label.
- b. Enclosures and electrical cabinets.
- c. Access doors and panels for concealed electrical items.
- d. Enclosed controllers.
- e. Contactors.
- f. Remote-controlled switches, dimmer modules, and control devices.

END OF SECTION 260553

SECTION 26 09 23 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Central Management System - The System shall utilize a Central Management System that is hosted by the system provider or specified hosting partner location.
2. Backhaul Communication Network - The System shall utilize a Backhaul Communication Network specified by the City and approved by the Vendor.
3. Field Devices.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show installation details for field devices and control system.
 1. Interconnection diagrams showing field-installed wiring.
 2. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of lighting control device to include in operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 CENTRAL MANAGEMENT SYSTEM

- A. Physical Features and Requirements.

1. The Central Management System will display screen images depicting the following features and functions, as applicable:
 - a. Map Data.
 - b. Satellite Image Data.
 - c. Control Point location.
 - d. Control Point equipment type (i.e. luminaire type).
 - e. Controller and Gateway status (i.e. online, online reporting error, offline).
 - f. Luminaire status (On, Off).
 - g. Luminaire Dimmed State.
 - h. Luminaire Location via controller integrated GPS receiver.
2. The Central Management System shall be accessible to individual users only by name and password.
3. The Central Management System shall be capable of restricting user access to specific functions. At a minimum, these functions shall include the following:
 - a. Creating and managing users and groups.
 - b. Configuration.
 - c. Monitoring.
 - d. Control.
 - e. Basic report generation.
4. The Central Management System shall be accessible through a handheld mobile device via a WEB BROWSER.
5. All asset data shall be stored on the Central Management System.
6. The Central Management System shall be capable of storing the following asset information for all Control Points:
 - a. Pole number.
 - b. Pole type.
 - c. Pole GPS location
 - d. Pole grouping.
 - e. Luminaire make and model.
 - f. Luminaire nominal input voltage.
 - g. Luminaire power requirement (wattage).
 - h. Luminaire installation date.
 - i. Utility billing account number.
7. The Central Management System shall store all remote monitoring data for a period needed to operate the system.

B. Logical Features and Requirements

1. The Central Management System shall ensure secure communication between itself and all Field Devices by logically enabling security features inherent to the underlying communications protocols.

2. The Central Management System shall be capable of detecting communication failures between Field Devices and the Central Management System.
3. The Central Management System shall be capable of delivering Field Device firmware upgrades over the Backhaul Communication Network.
4. The Central Management System shall be capable of remotely monitoring Field Device performance, in order to identify and report exceptions.

C. Power Trimming

1. All controllers shall continuously adjust the load consumption with 2% of the user defined target over the full temperature range.
2. All controllers shall utilize a power change ramp rate of 1 second per 1% of total load wattage change.
3. All controllers shall support Lumen Maintenance and Constant Light output over the life of the load (default is L70).

D. Management Features and Requirements

1. The Central Management System shall be capable of RETRIEVING and STORING the following online Control Point parameters:
 - a. Controller status (Online, Offline, Warnings, Errors).
 - b. Luminaire status (ON, OF, Dimmed State, Warnings, Errors).
 - c. Average input voltage (RMS) in ON state.
 - d. Average input current (mA) in ON state.
 - e. Average input power (W) in ON state.
 - f. Average input power factor in ON state.
 - g. Cumulative ON state time (minutes).
 - h. Cumulative energy consumption (kWh).
 - i. Actual GPS location via Controller integrated GPS receiver.
 - j. Temperature.
2. The Central Management System shall be capable programming the online Control Point parameter Reporting Frequency for ALL Control Points.
3. The Central Management System shall be capable of programming the online Control Point parameter Reporting Frequency for A SINGLE Control Point.
4. The Central Management System shall be capable of defining Luminaire groups.
5. The Central Management System shall be capable of Manual Control, whereby the ON/OFF and DIMMED state of a single Luminaire or group of Luminaires is modified in response to commands created by the Central Management System.
6. The Central Management System shall be capable of creating programs for Scheduled Control, whereby the ON/OFF and DIMMED state of a single Luminaire or a group of Luminaires is modified according to a predefined schedule.
7. The Central Management System shall be capable of creating programs for Scheduled Control containing a minimum of 6 times/events per day.
8. The Central Management System shall be capable of creating programs for Scheduled Control that is time-based, whereby Controllers modify Luminaire operation when a specific time in the schedule occurs, or event-based, whereby Controllers modify Luminaire operation when the next event in the schedule occurs.
9. The Central Management System shall be capable of creating programs for time-based Scheduled Control that are defined:

- a. On a daily recurring basis.
 - b. On a weekday recurring basis.
 - c. On a weekend recurring basis.
-
10. Field Devices shall be capable of true input power control, whereby the Luminaire DIMMED state is actuated to achieve to a desired true input power (percent relative watts).
 11. The Central Management System shall be capable of creating programs for automatically maintaining constant Luminaire light output (lumens) over time by compensating for Luminaire lumen depreciation.
 12. The Central Management System shall be capable of comparing all reported Control Point parameters with optional pre-defined maximum and minimum thresholds, and generating error messages in real-time (based on reported data availability) for any condition that violates a specified threshold a specified number (1 or more) of times.
 13. The Central Management System shall be capable of creating Remote Monitoring reports:
 - a. Based on the generation of an error message.
 - b. Based on a schedule.
 14. The Central Management System shall be capable of creating pre-defined Remote Monitoring reports containing:
 - a. Instances of communication loss between Field Devices and the Central Management System.
 - b. Control points with error conditions, sorted by error type and/or Electrical Service Point location.
 - c. Energy Consumption Data for individual Luminaries and/or groups of Luminaires.
 15. The Central Management System shall be capable of creating customized Remote Monitoring reports.
 16. The Central Management System shall be capable generating Notifications, whereby specified Remote Monitoring reports (pre-defined or customized) are sent to assigned users and/or user groups via text message (SMS) and/or email.

2.2 FIELD DEVICES

A. Physical Features and Requirements

1. Field Devices shall be capable of normal operation over an ambient temperature range of 40 degrees C to 50 degrees C (cold environment).
2. Field Devices installed external to luminaires shall be rated IP54 and allow any moisture to drain without effecting operation. The Gateway housing shall be rated IP66.
3. Field Devices shall operate from the following input voltage (nominal $\pm 10\%$) 120-277 AC RMS (For LED Post TOP Luminaire and 347V-480V for LED sports lighting).
4. The peak power requirement of will be less than Controller 2W, Gateway 3W.
5. Controllers shall be integrated (mechanically and electrically connected) at Control Points External to Luminaires, using a NEMA C136.41 standard polarized twist-lock receptacle for both electrical and dimming control signal connectivity.
6. Controllers shall be capable of actuating the status (ON state, OFF state) of Luminaires.

7. Controllers shall be capable of actuating a Luminaire OFF state that results in a ZERO watt power requirement for the Luminaire. It is understood that the Controller will require power to remain online.
8. Controllers shall be capable of actuating a Luminaire DIMMED state by creating A 0-10V control signal.
9. Actuated changes to Luminaire DIMMED states by Controllers shall occur at the following rate at a user of 1% change per second.
10. Controllers shall be capable or measuring instantaneous true input power, input voltage (RMS), input current and power factor.
11. True input power, input voltage (RMS), input current and power factor shall be measured, at each Control Point for the combined system of the Luminaire AND the Controller.
12. Each Controller shall be capable physically monitoring or measuring the following parameters:
 - a. Nominal sunrise and sunset times (via integrated photo detector).
 - b. GPS Location (via integrated GPS receiver).
 - c. Temperature.
13. Field Devices shall be capable of logging cumulative hours in the ON state for each Control Point.
14. Field Devices shall be capable of logging cumulative energy consumption at each Control Point.
15. During Offline Operation, Field Devices shall be capable of monitoring and STORING the following offline TIME-STAMPED Control Point parameters:
 - a. Controller status (Online, Offline, Warnings, Errors).
 - b. Luminaire status (ON, OFF, Dimmed State, Warnings, Errors).
 - c. Cumulative ON state time (minutes).
 - d. Cumulative energy consumption (kWh).
16. During Offline Operation Field Devices shall be capable of STORING measurements of voltage, current, power, power factor, energy (KWH) and ON time. Frequency and the number of days to be stored are user configurable.

B. Logical Features and Requirements

1. During Online Operation, Field Devices shall be capable of monitoring and REPORTING the following online Control Point parameters:
 - a. Controller status (Online, Offline, Warnings, Errors).
 - b. Luminaire status (ON, OF, Dimmed State, Warnings, Errors).
 - c. Average input voltage (RMS) in ON state.
 - d. Average input current (mA) in ON state.
 - e. Average input power (W) in ON state.
 - f. Average input power factor in ON state.
 - g. Cumulative ON state time (minutes).
 - h. Cumulative energy consumption (kWh).
 - i. Driver status (Warnings, Errors).
 - j. Ambient light (via integrated photoelectric sensor).
 - k. GPS location (via integrate GPS receiver).

1. Temperature internal to Controller.
 2. Field Devices shall respond to any single command received from the Backhaul Communication Network in less than 60 seconds.
 3. Field Devices shall automatically REPORT all data STORED during Offline Operation once Online Operation is restored.
- C. Control Features and Requirements
1. Field Devices shall be capable of controlling a single Luminaire or groups of Luminaires (contactors may be required if total load exceeds 450W).
 2. Changes in the ON/OFF or DIMMED states to groups of Luminaires shall be staggered to limit the inrush current through other electrical components (e.g. contactors, relays, circuit breakers) on the Luminaire group electrical circuit.
 3. Field Devices shall be capable of Manual Control, whereby the ON/OFF and DIMMED state of a single Luminaire or group of Luminaires is modified in response to commands from the Central Management System.
 4. Field Devices shall be capable of Scheduled Control, whereby the ON/OFF and DIMMED state of a single Luminaire or group of Luminaires is modified according to a predefined schedule.
 5. Field Devices shall be capable of Scheduled Control that is defined for a minimum of (Instructions: enter appropriate number) times/events per day).
 6. Field Devices shall be capable of Scheduled Control that is either time-based, whereby Controllers modify Luminaire operation when a specific time in the schedule occurs, or event-based, whereby Controllers modify Luminaire operation when the next event in the schedule occurs.
 7. Field Devices shall be capable of time-based Scheduled Control that is defined:
 - a. On a weekday recurring basis.
 - b. On a weekend recurring basis.
 8. Field Devices shall be capable of Adaptive Control, whereby the ON/OFF and DIMMED state of a single Luminaire or a group of Luminaires is modified in response to dynamic inputs from integral sensors or the Central Management System.
 9. During Offline Operation Field Devices shall be capable of maintaining Luminaire control by Continuing to operate according to the most recently programmed Scheduled Control or a default Scheduled Control if one has not yet been programmed.
 10. Field Devices shall be capable of true input power control, whereby the Luminaire DIMMED state is actuated to achieve to a desired true input power (percent relative watts).
- D. Energy Metering and Billing Transfer
1. All controllers shall contain a metrology subsystems that complies to ANSI 12.20 0.5% Metering Accuracy Class.
 2. The Control shall in all cases report the combined total of all energy consumed by both the controller and the load.
 3. Energy Metering shall start within 3 seconds of power being applied to the controller.
 4. Power Outage recovery events shall not result in more than 3 seconds of unmetered energy consumption.

5. The System shall export energy consumption for each controller at a minimum of once every 24 hours.
6. The system shall report that total energy consumption in 15 minute intervals that shall end on the ¼ hour GMT (IE 00:15:30:45).
7. All Data shall be formatted and transferred in accordance to the US DOE Green Button Data Formatting Standard.

E. Wireless Mesh

1. The Wireless Lighting Control System Shall: Utilize Licence free 915 MHz spectrum to minimise interference and increases range compared to 2400 MHz spectrum in all cases provide a wireless connection to all other controllers or gateways within 500 meters free from obstacles.
2. Transmit using a randomly selected channel from a group of a minimum of 50 discrete channels to minimise interference.
3. Comply with all IEEE 802315 g PHY communication standard requirements.
4. Comply with all IETF 6 Low PAN communication Standard Requirements.
5. Utilise a self-forming and self-restoring mesh communications protocol.

F. Security

1. All System components shall be assigned a unique permanent serial number by the manufacturer (MAC Address).
2. All System components will only use a system wide unique IPV6 address reference, no dynamic address schemes.
3. All Wireless connection will utilise a unique 128 bit ECC encryption key 256 bit Certificate Authority registered authentication key.
4. All wired connections will utilize a unique 256 bit encryption key and 256 bid Certificate Authority registered authentication key.
5. All encryption & authentication keys will be wirelessly revocable & updateable by the user should they be compromised.

2.3 SOFTWARE

A. Platform Architecture

1. Supports multiple developer frameworks and an ecosystem of application services to build, test, deploy, and, scale applications such as: Future Intelligent City Devices such as Gun Shot Detection, Motion Detection, Environmental Monitoring & Analysis, Video Surveillance, Traffic Analysis, Traffic Optimization, Vibration Detection, Parking Optimization.
2. Availability of a self-service portal where developers can access specialized services intended for use in Industrial Internet applications.
3. Supports Time Series Data Storage.
4. Supports Blob Data Storage.
5. Supports Relational Database Storage.
6. Microservices Based.
7. Context Based User Interface - Providing right information to the right user at the right time.
8. Supports Predictive and Operational Analytics.

B. File and Data Transfer

1. Ability to push data to the cloud by streaming batching or by uploading a file.

C. Store and Forward

1. Ability to manage intermittent connectivity by collecting and storing data locally and then forwarding to the cloud once connectivity is reestablished.

D. Local Data Store and Access

1. Capability to store data locally in the intelligent node for local access by say a service technician.

E. Sensor Data Aggregation

1. Ability to integrate data from multiple sensors and then push an aggregated data gathered from all of the sensors to Cloud.

F. Edge Analytics

1. Capability to run the computational algorithms directly on the data that is streaming of the Intelligent Node.

G. Certificate Management

1. End-to-end security using certificate management.

H. Device Positioning

1. Auto registration and provisioning of Intelligent Nodes for further management and software upgrades.

I. Device Decommissioning

1. Ability to Notify the Cloud/CMS when an Intelligent is offline and no longer needs to be managed.

J. Configuration Management

1. Ability to remotely configure the Intelligent Node and the track configuration changes over the lifetime of the Node.

2.4 RATED LIFE & RELIABILITY

- A. The rated life of all Field Devices shall be 15 years or more at an ambient temperature of 25 degrees Celsius.

- B. The Vendor shall report the reliability of the Field Devices, as measured by Mean Time between Failures (MTBF) according to Telcordia SR-332.

2.5 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables".

2.6 COMPONENT WARRANTY

- A. Warranty Period
 - 1. Hardware
 - a. All components shall be covered by a single-source written replacement warranty covering material and workmanship for a period of TEN (10) year.
 - 2. Software & Firmware
 - a. All software and firmware shall be covered by a written replacement warranty covering material and workmanship for a period of TWO (2) year.

PART 3 - EXECUTION

3.1 FIELD DEVICE INSTALLATION

- A. Install all field devices required to provide a complete outdoor wireless control system of pedestrian post top luminaires and skate park sports lighting.

3.2 CENTRAL MANAGEMENT INSTALLATION

- A. Install all hardware and software required to provide a complete outdoor wireless control system.

3.3 COMPONENT INSTALLATION

- A. Responsibility
 - 1. All Components shall be installed by the Vendor or their 3rd Party representative.
- B. Requirements
 - 1. All hardware, software and firmware necessary for installation, operation and management of all Components shall be provided.
- C. Vendor Services
 - 1. ALL Components shall be installed by the Vendor or their 3rd Party representative:

- a. The Vendor shall provide all pertinent installation and start up instructions and manuals in Portable Document Format (PDF).
- b. The Vendor or a manufacturer-qualified representative shall provide installation support in person, or Via telephone and/or the internet.
- c. The Vendor shall provide installation training.
- d. The Vendor and Resident Engineer shall jointly perform an installation audit.

3.4 WIRING INSTALLATION

- A. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch (13 mm).
- B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- C. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.5 SYTEM START UP

- A. Responsibility
 1. The System Start up shall be performed by the Vendor in conjunction with the City or their 3rd Party representative and supported by the vendor. REQUIREMENTS:
 - a. The Wireless communications shall be automatically established and optimized without the use of any form of "in field" programing. The use of field programing electronic tools/computes will not be required during the installation. The physical location of each controller shall be automatically transmitted to the CMS without any in field program requirements.
 - b. The System shall be examined for any hardware, software, or firmware incompatibilities or errors that occurred during Installation.
 - c. The Configuration period shall begin immediately following the completion of installation, successful Start-Up, and Successful demonstration of all System functions and capabilities.
 - d. The Configuration period shall include a trial period comprised of 30 consecutive calendar days of System operation. The trial will not start until the system has reached "substantial completion", been signed off by the Resident Engineer, and has met the specification requirements.
 - e. Over the course of the trial period, all System functions and capabilities described during Vendor training shall be successfully demonstrated.
 - f. Over the course of the trial period, all System functions and capabilities shall operate normally for at least ninety-eight Percent (98%) of the time.
 - g. The Commissioning Period shall end following Resident Engineer acceptance of a successful trial period.

B. Vendor Services

1. Training

- a. The Vendor shall provide comprehensive training at the City's facility, covering (at a minimum), Testing and programming, configuration, administration, operation, and troubleshooting of the system. The contractor shall integrate a review of the User's manual and commissioning materials into City Staff Training.
- b. The Vendor training shall be scheduled based on availability of City's staff.
- c. The Vendor shall provide training manuals and all other documentation (i.e. Operations and Maintenance manuals) in Adobe™ Acrobat format.
- d. The Vendor shall provide all necessary instructional equipment to be used during the training sessions for training purposes.
- e. The Vendor training shall provide instruction using the installed System (not using a remote system or a simulated system), and geared towards new users.
- f. The City may elect to record these training sessions for the City's sole use for future training purposes. The resulting recordings shall be the sole property of the City and for the sole use of the City.
- g. The Vendor shall specify the degree of coordination needed with the City's IT staff in regard to communications with existing systems. The System is Setup and Configured by the Vendor or their 3rd Party. The system setup may require a manufacturer or manufacturer-authorized representative to be available during the testing period.

3.6 IDENTIFICATION

- A. Identify components and power and control wiring according to Section 260553 "Identification for Electrical Systems".
 1. Identify controlled circuits wireless field devices controlled with the outdoor lighting control system.
 2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.

3.7 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 1. Operational Test: After installing and after electrical circuitry has been energized, start units to confirm proper outdoor wireless lighting control system operation.
 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls field devices, software and equipment.
- B. Lighting control devices will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.8 SYSTEM MAINTENANCE

- A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting field devices to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
1. For daylighting controls, adjust set points and deadband controls to suit the City's operations.
- B. Wireless Control System Maintenance:
1. Responsibility
 - a. The System shall be maintained by the City or their 3rd party contractor.
 2. Vendor Services
 - a. The System will be maintained by the City or their 3rd Party Representative:
 - b. The Vendor shall provide comprehensive maintenance training at the City's facility, covering all aspects of The System.
 - c. The Vendor shall provide hardware and software maintenance and support according to the warranty terms for the duration of the warranty period. Any Maintenance terms shall start following the applicable warranty period.
 - d. The Vendor shall specify any and all mandatory maintenance required to maintain the terms of the warranty.
 - e. Software and firmware upgrades, maintenance and support shall be provided for one year at no extra cost.

END OF SECTION 260923

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

- A. ATS: Acceptance testing specification.
- B. GFCI: Ground-fault circuit interrupter.
- C. GFEP: Ground-fault equipment protection.
- D. MCCB: Molded-case circuit breaker.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of panelboard.

- 1. Include materials, switching and overcurrent protective devices, SPDs, accessories, and components indicated.
- 2. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

- B. Shop Drawings: For each panelboard and related equipment.

- 1. Include dimensioned plans, elevations, sections, and details.
- 2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.
- 3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
- 4. Detail bus configuration, current, and voltage ratings.
- 5. Short-circuit current rating of panelboards and overcurrent protective devices.
- 6. Retain first subparagraph below if series rating of overcurrent protective devices is used. If some, but not all, devices are series rated, indicate on Drawings which are fully rated and which series rated.

7. Include evidence of NRTL listing for series rating of installed devices.
8. Retain first subparagraph below if SPD is factory mounted in panelboard.
9. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
10. Include wiring diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For panelboards and components to include in operation and maintenance manuals. In addition "Operation and Maintenance Data," shall include the following:
 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Keys: Four spares for each type of panelboard cabinet lock.
 2. Circuit Breakers Including GFCI and GFEP Types: Two spares for each panelboard.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: ISO 9001 or 9002 certified.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.
- B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.10 FIELD CONDITIONS

- A. Environmental Limitations:

1. Do not deliver or install panelboards until equipment base in spaces is complete and dry, work above panelboards is complete.
 2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Not exceeding minus 22 deg F (minus 30 deg C) to plus 104 deg F (plus 40 deg C).
 - b. Altitude: Not exceeding 6600 feet (2000 m).
- B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
1. Ambient temperatures within limits specified.
 2. Altitude not exceeding 6600 feet (2000 m).
- C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by the City or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
1. Notify the City / Resident Engineer no fewer than five days in advance of proposed interruption of electric service.
 2. Do not proceed with interruption of electric service without Resident Engineer's written permission.
 3. Comply with NFPA 70E.
- 1.11 WARRANTY
- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.
1. Panelboard Warranty Period: 24 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANELBOARDS AND LOAD CENTERS COMMON REQUIREMENTS

- A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with NEMA PB 1.
- E. Comply with NFPA 70.
- F. Enclosures: Surface pedestal-mounted, dead-front cabinets.

1. Rated for environmental conditions at installed location.
 - a. Outdoor Locations: NEMA 250, Type 3R.
 2. Height: 84 inches (2.13 m) maximum.
 3. Unmetered, Type III-BF commercial pedestal with total number of branch circuits per panel board schedule and space for control.
 4. Finishes:
 - a. Panels and Trim: galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
 - b. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.
- G. Incoming Mains:
1. Location: Bottom.
 2. Main Breaker: As shown in electrical drawing panel schedule.
- H. Phase, Neutral, and Ground Buses:
1. Material: Hard-drawn copper, 98 percent conductivity.
 - a. Plating shall run entire length of bus.
 - b. Bus shall be fully rated the entire length.
 2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
 3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
 4. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.
- I. Conductor Connectors: Suitable for use with conductor material and sizes.
1. Material: Hard-drawn copper, 98 percent conductivity.
 2. Terminations shall allow use of 75 deg C rated conductors without derating.
 3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
 4. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
 5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
- J. Future Devices: Panelboards or load centers shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- K. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.

1. Panelboards and overcurrent protective devices rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 10,000 A rms symmetrical.
2. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V shall have short-circuit ratings as shown on Drawings, but not less than 14,000 A rms symmetrical.

2.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. Eaton.
 2. General Electric Company; GE Energy Management - Electrical Distribution.
 3. Siemens Energy.
- B. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.
1. Thermal-Magnetic Circuit Breakers:
 - a. Inverse time-current element for low-level overloads.
 - b. Instantaneous magnetic trip element for short circuits.
 2. MCCB Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Breaker handle indicates tripped status.
 - c. UL listed for reverse connection without restrictive line or load ratings.
 - d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - e. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and HID lighting circuits.
 - f. Multipole units enclosed in a single housing with a single handle.
 - g. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in off position.
 - h. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

2.4 IDENTIFICATION

- A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.
- B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.
- C. Circuit Directory: Directory card inside panelboard door, mounted in metal frame with transparent protective cover.
 - 1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.
- B. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.
- C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.
- D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Coordinate layout and installation of panelboards and components with other construction. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Comply with NECA 1.
- C. Install panelboards and accessories according to NEMA PB 1.1.
- D. Equipment Mounting:
 - 1. Install panelboards on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations as shown in drawing details.
 - 2. Attach panelboard to the vertical finished or structural surface behind the panelboard.
- E. Comply with manufacturer's mounting and anchoring requirements.

- F. Mount panelboard cabinet plumb and rigid without distortion of box.
- G. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes.
- H. Install filler plates in unused spaces.

3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate the City's / Resident Engineer final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- D. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test for low-voltage circuit breakers stated in NETA ATS, Paragraph 7.6 Circuit Breakers and Paragraph 7.19.1 Surge Arrestors, Low-Voltage.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- E. Panelboards will be considered defective if they do not pass tests and inspections.

- F. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
- B. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes. Prior to making circuit changes to achieve load balancing, inform Resident Engineer of effect on phase color coding.
 - 1. Measure loads during period of normal facility operations.
 - 2. Perform circuit changes to achieve load balancing outside normal facility operation schedule or at times directed by the Resident Engineer. Avoid disrupting services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
 - 3. After changing circuits to achieve load balancing, recheck loads during normal facility operations. Record load readings before and after changing circuits to achieve load balancing.
 - 4. Tolerance: Maximum difference between phase loads, within a panelboard, shall not exceed 20 percent.

END OF SECTION 262416

SECTION 26 56 13 - LIGHTING POLES AND STANDARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Poles and accessories for support of luminaires.

1.3 DEFINITIONS

- A. EPA: Equivalent projected area.
- B. Luminaire: Complete lighting fixture.
- C. Pole: Luminaire-supporting structure.
- D. Standard: See "Pole."

1.4 ACTION SUBMITTALS

- A. Product Data: For each pole, accessory, and luminaire-supporting, arranged as indicated.
 - 1. Include data on construction details, profiles, EPA, cable entrances, materials, dimensions, weight, rated design load, and ultimate strength of individual components.
 - 2. Include finishes for lighting poles and luminaire-supporting devices.
 - 3. Anchor bolts.
 - 4. Manufactured pole foundations.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and mounting and attachment details.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Detail fabrication and assembly of poles and pole accessories.
 - 4. Foundation construction details, including material descriptions, dimensions, anchor bolts, support devices, and calculations, signed and sealed by a professional engineer licensed in the state of installation.
 - 5. Anchor bolt templates keyed to specific poles and certified by manufacturer.

6. Method and procedure of pole installation. Include manufacturer's written installations.

1.5 INFORMATIONAL SUBMITTALS

- A. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements according to AASHTO LTS-6-M and that load imposed by luminaire and attachments has been included in design. The certification shall be based on design calculations signed and sealed by a professional engineer.
- B. Qualification Data: For Installer and testing agency.
- C. Seismic Qualification Certificates: For luminaire, accessories, and components, from manufacturer.
 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Material Test Reports:
 1. For each pole, by a qualified testing agency.
- E. Source quality-control reports.
- F. Sample Warranty: Manufacturer's standard warranty.
- G. Soil test reports

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For poles to include in operation and maintenance manuals.
 1. In addition to "Operation and Maintenance Data," include pole manufacturer's inspection and repair procedures.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Pole repair materials.

1.8 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for foundation testing.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Store poles on decay-resistant skids at least 12 inches (300 mm) above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.
- B. Retain factory-applied pole wrappings on metal poles until right before pole installation. Handle poles with web fabric straps.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of pole(s) that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within a specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs from special warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.
 - 2. Warranty Period for Corrosion Resistance: Five years from date of Substantial Completion.
 - 3. Warranty Period for Color Retention: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, to design pole foundation.
- B. Seismic Performance: Foundation and pole shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified."
 - 2. Component Importance Factor: 1.5.
- C. Structural Characteristics: Comply with AASHTO LTS-6-M.
- D. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied according to AASHTO LTS-6-M.
- E. Live Load: Single load of 500 lbf (2200 N) distributed according to AASHTO LTS-6-M.
- F. Wind Load: Pressure of wind on pole and luminaire, calculated and applied according to AASHTO LTS-6-M.
 - 1. Basic wind speed for calculating wind load for poles 50 feet (15 m) high or less is 90 mph (40 m/s).
 - a. Wind Importance Factor: 1.0.
 - b. Minimum Design Life: 25 years.

c. Velocity Conversion Factor: 1.0.

G. Strength Analysis: For each pole, multiply the actual EPA of luminaires and brackets by a factor of 1.1 to obtain the EPA to be used in pole selection strength analysis.

H. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.

2.2 STEEL POLES

A. Source Limitations: Obtain poles from single manufacturer or producer.

B. Source Limitations: For poles, obtain each color, grade, finish, type, and variety of pole from single source with resources to provide products of consistent quality in appearance and physical properties.

C. Poles: Comply with ASTM A 500/A 500M, Grade B carbon steel with a minimum yield of 46,000 psig (317 MPa); one-piece construction up to 40 feet (12 m) in height with access handhole in pole wall.

1. Shape: Round, straight.
2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

D. Brackets for Luminaires: Detachable, cantilever, without underbrace.

1. Adaptor fitting welded to pole, allowing the bracket to be bolted to the pole-mounted adaptor, then bolted together with stainless-steel bolts.
2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire. Match pole material and finish.

E. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

F. Fasteners: Size and type as determined by manufacturer. Corrosion-resistant items compatible with support components.

1. Materials: Compatible with poles and standards as well as the substrates to which poles and standards are fastened and shall not cause galvanic action at contact points.
2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.

G. Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, complying with requirements in Section 260526 "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size indicated, and accessible through handhole.

H. Steps: Fixed steel, with nonslip treads.

1. For climbing positions, install at 15-inch (381-mm) vertical spacing, alternating on opposite sides of pole, oriented 180 degrees from each other; first step shall be at an elevation 10 feet (3 m) above finished grade.
 2. For working positions, install steps on opposite side of pole, oriented 180 degrees from each other at the same elevation.
- I. Handhole: Oval shaped, with minimum clear opening of 2-1/2 by 5 inches (65 by 130 mm), with cover secured by stainless-steel captive screws.
- J. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.
1. Surface Preparation: Clean surfaces according to SSPC-SP 1 to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, according to SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
 2. Interior Surfaces of Pole: One coat of bituminous paint, or otherwise treat for equal corrosion protection.
 3. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high gloss, high-build polyurethane enamel.
 - a. Color: As selected by Resident Engineer from manufacturer's full range.
- K. Powder-Coat Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.
1. Surface Preparation: Clean surfaces according to SSPC-SP 1 to remove dirt, oil, grease, and other contaminants that could impair powder coat bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, according to SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
 2. Powder Coat: Comply with AAMA 2604.
 - a. Electrostatic-applied powder coating; single application and cured to a minimum 2.5- to 3.5-mils dry film thickness. Coat interior and exterior of pole for equal corrosion protection.
 - b. Color: As selected by Resident Engineer from manufacturer's full range.

2.3 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine poles, luminaire-mounting devices, lowering devices, and pole accessories before installation. Components that are scratched, dented, marred, wet, moisture damaged, or visibly damaged are considered defective.
- C. Examine roughing-in for foundation and conduit to verify actual locations of installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 POLE FOUNDATION

- A. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123 M; and with top-plate and mounting bolts to match pole-base flange and strength required to support pole, luminaire, and accessories. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."
- B. Power-Installed Screw Foundations: Factory fabricated by pole manufacturer, with structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123M; and with top-plate and mounting bolts to match pole-base flange and strength required to support pole, luminaire, and accessories.
 - 1. Baseplate: Stamped with manufacturer's name, date of production, and cable entry.
- C. Anchor Bolts: Install plumb using manufacturer-supplied [steel] [plywood] template, uniformly spaced.

3.3 POLE INSTALLATION

- A. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on pole.
- B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on drawing.
 - 1. Fire Hydrants and Water Piping: 60 inches (1520 mm).
 - 2. Water, Gas, Electric, Communications, and Sewer Lines: 10 feet (3 m).
 - 3. Trees: 15 feet (5 m) from tree trunk.
- C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Section 033000 "Cast-in-Place Concrete."

- D. Foundation-Mounted Poles: Mount pole with leveling nuts and tighten top nuts to torque level according to pole manufacturer's written instructions.
 - 1. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
 - 2. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
 - 3. Install base covers unless otherwise indicated.
 - 4. Use a short piece of 1/2 -inch (13-mm) diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.
- E. Raise and set pole using web fabric slings (not chain or cable) at locations indicated by manufacturer.

3.4 CORROSION PREVENTION

- A. Steel Conduits: Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50-percent overlap.

3.5 GROUNDING

- A. Ground Metal Poles and Support Structures: Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."
 - 1. Install grounding electrode for each pole unless otherwise indicated.
 - 2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

3.6 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.7 FIELD QUALITY CONTROL

- A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:
 - 1. Inspect poles for nicks, mars, dents, scratches, and other damage.
 - 2. System function tests.

END OF SECTION 265613

SECTION 26 56 19 – LED EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.
2. Luminaire supports.
3. Luminaire-mounted photoelectric relays.

B. Related Requirements:

1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
2. Section 265613 "Lighting Poles and Standards" for poles and standards used to support exterior lighting equipment.

1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color rendering index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. Lumen: Measured output of lamp and luminaire, or both.
- F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of luminaire.
 1. Arrange in order of luminaire designation.
 2. Include data on features, accessories, and finishes.

3. Include physical description and dimensions of luminaire.
 4. Lamps, include life, output (lumens, CCT, and CRI), and energy-efficiency data.
 5. Wiring diagrams for power, control, and signal wiring.
 6. Photoelectric relays.
 7. Means of attaching luminaires to supports and indication that the attachment is suitable for components involved.
- B. Shop Drawings: For nonstandard or custom luminaires.
1. Include plans, elevations, sections, and mounting and attachment details.
 2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 3. Include diagrams for power, signal, and control wiring.
- C. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.
- D. Delegated-Design Submittal: For luminaire supports.
1. Include design calculations for luminaire supports.
- 1.5 INFORMATIONAL SUBMITTALS
- A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Luminaires.
 2. Structural members to which equipment and luminaires will be attached.
 3. Underground utilities and structures.
 4. Existing underground utilities and structures.
 5. Above-grade utilities and structures.
 6. Existing above-grade utilities and structures.
- B. Qualification Data: For testing laboratory providing photometric data for luminaires.
- C. Seismic Qualification Certificates: For luminaires, accessories, and components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Product Certificates: For each type of the following:
1. Luminaire.
 2. Photoelectric relay.

- E. Product Test Reports: For each luminaire, for tests performed by manufacturer.
- F. Source quality-control reports.
- G. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and photoelectric relays to include in operation and maintenance manuals.
 - 1. Provide a list of all lamp types used on Project. Use ANSI and manufacturers' codes.
 - 2. Provide a list of all photoelectric relay types used on Project; use manufacturers' codes.

1.7 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturers' laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
- B. Provide luminaires from a single manufacturer for each luminaire type.
- C. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
- D. Mockups: For exterior luminaires, complete with power and control connections.
 - 1. Obtain Resident Engineer's approval of luminaires in mockups before starting installations.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Resident Engineer specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping.

1.9 FIELD CONDITIONS

- A. Verify existing and proposed utility structures prior to the start of work associated with luminaire installation.
- B. Mark locations of exterior luminaires for approval by Resident Engineer prior to the start of luminaire installation.

1.10 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures, including luminaire support components.
 - b. Faulty operation of luminaires and accessories.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 2. Warranty Period: 5 year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- B. Seismic Performance: Luminaires and lamps shall be labeled vibration and shock resistant.
 - 1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified."

2.2 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. UL Compliance: Comply with UL 1598 and listed for wet location.
- C. Lamp base complying with ANSI C81.61 or IEC 60061-1.
- D. CRI of minimum 70. CCT of 4100 K.
- E. L70 lamp life of 70000 hours.
- F. Lamps dimmable from 100 percent to 0 percent of maximum light output.
- G. Internal driver.
- H. Nominal Operating Voltage: 120 V ac.
- I. In-line Fusing: On the primary for each luminaire.
- J. Lamp Rating: Lamp marked for outdoor use.

- K. Source Limitations: Obtain luminaires from single source from a single manufacturer.
- L. Source Limitations: For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.

2.3 LUMINAIRE-MOUNTED PHOTOELECTRIC RELAYS

- A. Comply with UL 773 or UL 773A.
- B. Contact Relays: Factory mounted, single throw, designed to fail in the on position, and factory set to turn light unit on at 1.5 to 3 fc (16 to 32 lx) and off at 4.5 to 10 fc (48 to 108 lx) with 15-second minimum time delay. Relay shall have directional lens in front of photocell to prevent artificial light sources from causing false turnoff.
 - 1. Relay with locking-type receptacle shall comply with ANSI C136.10.
 - 2. Adjustable window slide for adjusting on-off set points.

2.4 LUMINAIRE TYPES

- A. Area and Site:
 - 1. Luminaire Shape: Round.
 - 2. Mounting: Pole.
 - 3. Luminaire-Mounting Height: 201.
 - 4. Distribution: Type I.
 - 5. Diffusers and Globes: Heat and impact resistant tempered flat glass.
 - 6. Housings:
 - a. Seamless-aluminum housing and heat sink.

2.5 FINISHES

- A. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire electrical conduit to verify actual locations of conduit connections before luminaire installation.

- C. Examine pedestrian bridge and pole base bridge overhang for suitable conditions where luminaires will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Comply with NECA 1.
- B. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer, and coordinated with pedestrian bridge fabricator.
- C. Install lamps in each luminaire.
- D. Fasten luminaire to structural support.
- E. Supports:
 - 1. Sized and rated for luminaire weight.
 - 2. Able to maintain luminaire position after cleaning and relamping.
 - 3. Support luminaires without causing deflection of finished surface.
 - 4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.
- F. Wall-Mounted Luminaire Support:
- G. Wiring Method: Install cables in raceways. Conceal raceways and cables.
- H. Install luminaires level, plumb, and square with finished grade unless otherwise indicated.
- I. Coordinate layout and installation of luminaires with other construction.
- J. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.
- K. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and 260533 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

3.3 CORROSION PREVENTION

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
- B. Steel Conduits: Comply with Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

- A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
 - 2. Verify operation of photoelectric controls.
- C. Illumination Tests:
 - 1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IES testing guide(s):
 - a. IES LM-5.
 - b. IES LM-50.
 - c. IES LM-52.
 - d. IES LM-64.
 - e. IES LM-72.
 - 2. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
- D. Luminaire will be considered defective if it does not pass tests and inspections.
- E. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.6 DEMONSTRATION

- A. Train the City's maintenance personnel to adjust, operate, and maintain luminaires and photocell relays.

3.7 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
3. Adjust the aim of luminaires in the presence of the Resident Engineer.

END OF SECTION 265619

SECTION 26 56 68 - EXTERIOR ATHLETIC LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

- A. Section includes lighting for the following outdoor sports venues:

1. Skate Park.

- B. Related Requirements:

1. Section 260923 "Lighting Control Devices" for automatic and remote control of lighting, including outdoor wireless control and Central Management System.
2. Section 265613 "Lighting Poles and Standards" for poles and standards used to support lighting equipment.
3. Section 265619 "LED Exterior Lighting" for exterior LED luminaires and photoelectric relays.

1.3 DEFINITIONS

- A. Coefficient of Variation (CV): A statistical measure of the weighted average of all relevant illumination values for the playing area, expressed as the ratio of the standard deviation for all illuminance values to the mean illuminance value.
- B. Fixture: See "Luminaire."
- C. Illuminance: The metric most commonly used to evaluate lighting systems. It is the density of luminous flux, or flow of light, reaching a surface divided by the area of that surface.
1. Horizontal Illuminance: Measurement in foot-candles (lux), on a horizontal surface 36 inches (914 mm) above ground unless otherwise indicated.
 2. Target Illuminance: Average maintained illuminance level, calculated by multiplying initial illuminance by LLF.
 3. Vertical Illuminance: Measurement in foot-candles (lux), in four directions on a vertical surface, at an elevation coinciding with plane height of horizontal measurements.
- D. LC: Lighting Certified.
- E. Light-Loss Factor (LLF): A factor used in calculating the level of illumination after a given period of time and under given conditions. It takes into account temperature, dirt accumulation

on the luminaire, lamp depreciation, maintenance procedures, and atmospheric conditions. An LLF includes a recoverable light-loss factor.

- F. Luminaire: A complete lighting unit, internally lighted exit sign, or emergency lighting unit. Luminaires include lamps and the parts required to distribute light, position and protect lamps, and connect lamps to power supply. Note that "fixture" and "luminaire" may be used interchangeably and the "IES Lighting Handbook" uses "luminaire" over "fixture."
- G. Pole: Luminaire support structure, including tower used for large area illumination.
- H. Uniformity Gradient (UG): The rate of change of illuminance on the playing field, expressed as a ratio between the illuminances of adjacent measuring points on a uniform grid.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of lighting product.
 - 1. Arrange in order of luminaire designation.
 - 2. Include data on features, accessories, and finishes.
 - 3. Include physical description and dimensions of the luminaires.
 - 4. Ballast, including BF, UL listing and recognition, ANSI certification, and Energy Independence and Security Act of 2007 compliance.
 - 5. Lamps, including life, output (lumens, CCT, and CRI), and energy-efficiency data.
 - 6. Photometric data and adjustment factors based on laboratory tests, complying with IES "Lighting Measurements Testing and Calculation Guides," of each lighting luminaire type. The adjustment factors shall be for lamps, drivers, and accessories identical to those indicated for the luminaire as applied in this Project.
 - a. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
 - b. Manufacturer Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the NVLAP for Energy Efficient Lighting Products.
 - 7. Light Grid Node devices – outdoor wireless control system.
 - 8. Means of attaching luminaires to supports and indication that attachment is suitable for components involved.
 - 9. Light Grid Gateway – remote monitoring and control, utility grade energy measurement.
- B. Shop Drawings: For nonstandard or custom luminaires.
 - 1. Include plans, elevations, sections, and mounting and attachment details.
 - 2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, and required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include diagrams for power, signal, and control wiring.
- C. Product Schedule: For luminaires and lamps. **Use same designations indicated on Drawings.**

- D. Delegated-Design Submittal: For exterior athletic lighting indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
1. Drawings and specifications for construction of lighting system.
 2. Manufacturer's determination of LLF used in design calculations.
 3. Lighting system design calculations for the following:
 - a. Target illuminance.
 - b. Point calculations of horizontal and vertical illuminance, CV, and UG at minimum grid size and area.
 - c. Point calculations of horizontal and vertical illuminance in indicated areas of concern for spill light.
 - d. Calculations of source intensity of luminaires observed at eye level from indicated properties near the playing fields.
 4. Electrical system design calculations for the following:
 - a. Total connected and estimated peak-demand electrical load, in kilowatts, of lighting system.
 - b. Capacity of feeder required to supply lighting system.
 5. Wiring requirements, including required conductors, cables, and wiring methods.
 6. Structural analysis data and calculations used for pole selection.
 - a. Manufacturer Wind-Load Strength Certification: Submit certification that selected total support system, including poles, complies with AASHTO LTS-6-M for location of Project.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Luminaires.
 2. Luminaire support structures.
 3. Limits of athletic fields.
 4. Proposed underground utilities and structures.
 5. Existing underground utilities and structures.
 6. Wireless remote control and monitoring system.
- B. Qualification Data: For qualified Installer, manufacturer, testing laboratory providing photometric data for luminaires and field testing agency.
- C. Seismic Qualification Certificates: For luminaires, accessories, and components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Welding certificates.
- E. Product Certificates:
1. For each type of ballast for bi-level and dimmer-controlled luminaire, from manufacturer.
 2. For support structures, including brackets, arms, appurtenances, bases, anchorages, and foundations, from manufacturer.
- F. Field quality-control reports.
- G. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires to include in operation and maintenance manuals.
1. Provide a list of all lamp types used on Project. Use ANSI and manufacturers' codes.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Lamps: 2 of each type and rating installed. Furnish at least one of each type.
 2. Glass, Acrylic, and Plastic Lenses, Covers, and Other Optical Parts: One for every 15 of each type and rating installed. Furnish at least one of each type.
 3. Driver: One for every 15 of each type and rating installed. Furnish at least one of each type.
 4. Fuses: Ten for every 30 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Manufacturer Qualifications: Manufacturer's responsibilities include fabricating sports lighting and providing professional engineering services needed to assume engineering responsibility.
1. Engineering Responsibility: Preparation of delegated-design submittals and comprehensive engineering analysis by a qualified professional engineer who is additionally certified as an LC by the National Council on Qualifications for the Lighting Professions.

- C. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturers' laboratory accredited under the NVLAP for Energy Efficient Lighting Products.
- D. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products and complying with applicable IES testing standards.
- E. Field Testing Agency Qualifications: An independent testing agency that is accredited under the NVLAP for Energy Efficient Lighting Products, a member company of NETA, or an NRTL as defined in 29 CFR 1910.7, with the experience and capability to conduct field testing according to IES LM-5.
- F. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M.
 - 2. AWS D1.2/D1.2M.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of luminaires, lamps, and luminaire alignment products and to correct misalignment that occurs subsequent to successful acceptance tests. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, and unauthorized repairs and alterations from special warranty coverage.
 - 1. Luminaire Warranty: Luminaire and luminaire assembly (excluding fuses and lamps) shall be free from defects in materials and workmanship for a period of 10 years from date of Substantial Completion.
 - 2. Lamp Warranty:
 - a. Replace lamps and fuses that fail within 10 months from date of Substantial Completion.
 - b. Provide replacement lamps for lamps that fail within months 13 thru 24 from date of Substantial Completion.
 - 3. Alignment Warranty: Accuracy of alignment of luminaires shall remain within specified illuminance uniformity ratios for a period of 2 years from date of successful completion of acceptance tests.
 - a. Realign luminaires that become misaligned during the warranty period.
 - b. Replace alignment products that fail within the warranty period.
 - c. Verify successful realignment of luminaires by retesting as specified in "Field Quality Control" Article.

- B. Warranty Period: 10 year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Facility Type: Recreational or social facility.
- B. Illumination Criteria:
1. Minimum average target illuminance level for each lighted area for each sports venue and for the indicated class of play according to IES RP-6.
 2. CV and maximum-to-minimum uniformity ratios for each lighted area equal to or less than those listed in IES RP-6 for the indicated class of play.
 3. UG levels within each lighted area equal to or less than those listed in IES RP-6 for the indicated speed of sport.
- C. Illumination Criteria:
1. Minimum Average Target Illumination: 30fc.
 2. Maximum-to-Minimum Uniformity Ratio: not to exceed 2:1.
- D. Illumination Calculations: Computer-analyzed point method complying with IES RP-6 to optimize selection, location, and aiming of luminaires.
1. Grid Pattern Dimensions: For playing areas of each sport and areas of concern for spill-light control, correlate and reference calculated parameters to the grid areas. Each grid point represents the center of the grid area defined by the length and width of the grid spacing.
 2. Spill-Light Control: Minimize spill light for each playing area on adjacent and nearby areas.
 - a. Prevent light trespass on properties near Project as defined by City of San Diego.
 - b. For areas indicated on Drawings as "spill-light critical," limit the level of illuminance directed into the area from any luminaire or group of luminaires, and measured 36 inches (914 mm) above grade to the following:
 - 1) Maximum Horizontal Illuminance: 0.25 fc (2.7 lux).
 - 2) Maximum Vertical Illuminance from the Direction of the Greatest Contribution of Light: 1.0 fc (10.8 lux).
 - c. Calculate the horizontal and vertical illuminance due to spill light for points spaced 20 feet (6 m) apart in areas indicated on Drawings as "spill-light critical," to ensure that design complies with the above limits.
 3. Glare Control: Design illumination for each playing area to minimize direct glare in adjacent and nearby areas.
 - a. Design source intensity of luminaires that may be observed at an elevation of 60 inches (1524 mm) above finished grade from nearby properties.

- b. Design source intensity of luminaires that may be observed at an elevation of 60 inches (1524 mm) above finished grade from designated "spill-light critical" areas.
 4. Determine LLF according to IES RP-6 and manufacturer's test data.
 - a. Use LLD at 95 percent of rated lamp life. LLF shall be applied to initial illumination to ensure that target illumination is achieved at 100 percent of lamp life and shall include consideration of field factor.
 - b. LLF shall not be higher than 70 percent and may be lower when determined by manufacturer after application of the ballast output and optical system output according to IES RP-6.
 5. Luminaire-Mounting Height: Comply with IES RP-6, with consideration for requirements to minimize spill light and glare.
 6. Luminaire Placement: Luminaire clusters shall be outside the glare zones defined by IES RP-6.
- E. Skate Park
1. IESNA RP-6:
 2. Speed of Sport: Fast.
 3. Grid Pattern Dimensions: 20x30 grid.
- F. Lighting Control: Outdoor wireless remote control and monitoring system.
1. Control Station: Central Management System.
 2. Light Levels: Two levels of control - 100/50 percent of minimum target illumination.
- G. Electric Power Distribution Requirements:
1. Electric Power: 480 V; three phases.
 - a. Include roughing-in of service indicated for nonsports improvements on Project site.
 - b. Balance load between phases. Install wiring to balance three phases at each support structure.
 - c. Include required overcurrent protective devices and individual lighting control for each sports field or venue.
 - d. Include indicated feeder capacity and panelboard provisions for future lighted sports field construction.
- H. Maximum Total Load: 25 A.
1. Maximum Total Voltage Drop from Source to Load: 3 percent, including voltage drops in branch circuit, subfeeder, and feeder.
- I. Seismic Performance: Luminaires, ballasts, and support structures shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified."

2.2 LUMINAIRES, LAMPS, AND BALLASTS

A. Luminaires: Complying with requirements described in drawing sheet E-3-9

1. Listed and labeled, by an NRTL acceptable to authorities having jurisdiction, for compliance with UL 1598 for installation in wet locations.
2. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without using tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent their accidental falling during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lens. Designed to disconnect ballast when door opens.
3. Exposed Hardware: Stainless-steel latches, fasteners, and hinges.
4. Spill-Light Control Devices: Internal louvers and external baffles furnished by manufacturer and designed for secure attachment to specific luminaire.
5. Luminaires for Skate Park shall be bracket-mounted, full-cutoff type with integral ballasts.
6. Lamps for Skate Park Luminaires: LED, rated 320 W:

B. Ballast Mounting: Integral with Luminaire location of associated luminaires unless otherwise indicated.

2.3 SUPPORT STRUCTURES

A. Support Structures: Steel poles and other support structures, brackets, arms, appurtenances, bases, anchorages and foundations as complying with requirements described in Section 265613 "Lighting Poles and Standards."

2.4 POWER DISTRIBUTION AND CONTROL

- A. Wiring Method for Feeders, Subfeeders, Branch Circuits, and Control Wiring: Underground nonmetallic raceway; No. 10 AWG minimum conductor size for power wiring.
- B. Overhead-, pole-, or structure-supported wiring and transformers are not permitted.
- C. Electrical Enclosures Exposed to Weather: NEMA 250, Type 3R enclosure constructed from corrosion-resistant material, with hinged doors fitted with padlock hasps or lockable latches.

2.5 POLE AND BASE PROTECTION

- A. Pole Pads: Wraparound pad, with 4 inches (100 mm) of extra-firm polyfoam, 360-degree coverage of ground-mounted poles and supports, continuous hook-and-loop fastening; and not less than 72 inches (1820 mm) high.

2.6 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire electrical and communications conduit to verify actual locations of connections before pole or luminaire installation.
- C. Examine foundations for suitable conditions where luminaires will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with NECA 1.
- B. Wiring Method: Install cables in raceways, except when cables are installed within boxes and poles. Conceal raceways and cables.
 - 1. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and 260533 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.
- C. Coordination layout and installation of luminaires with other construction.
- D. Use web fabric slings (not chain or cable) to raise and set structural members. Protect equipment during installation to prevent corrosion.
- E. Install poles and other structural units level, plumb, and square.
- F. Install luminaires at height and aiming angle as indicated on Drawings.
- G. Except for embedded structural members, grout void between pole base and foundation. Use nonshrinking or expanding concrete grout firmly packed in entire void space. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole. Nonshrink grout is specified in Section 055000 "Metal Fabrications."

- H. Extend cast-in-place bolted base foundations 36 inches (914 mm) above grade, minimum.

3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform the following tests and inspections:
 - 1. After installing sports lighting system and after electrical circuits have been energized, perform proof-of-performance field measurements and analysis for compliance with requirements.
 - 2. Playing and Other Designated Areas: Make field measurements at intersections of grids, dimensioned and located as specified in "Performance Requirements" Article and as described below:
 - a. Skate Park: Measure at least 80 points.
 - 3. Make field measurements at established test points in areas of concern for spill light and glare.
 - 4. Perform analysis to demonstrate correlation of field measurements with specified illumination quality and quantity values and corresponding computer-generated values that were submitted with engineered design documents. Submit a report of the analysis. For computer-generated values, use manufacturer's lamp lumens that are adjusted to lamp age at time of field testing.
- C. Correction of Illumination Deficiencies for Playing Areas: Make corrections to illumination quality or quantity, measured in field quality-control tests, that varies from specified illumination criteria by plus or minus 10 percent.
 - 1. Add or replace luminaires; change mounting height and aiming; or install louvers, shields, or baffles.
 - 2. If luminaires are added or mounting height is changed, revise aiming and recalculate and modify or replace support structures if indicated.
 - 3. Do not replace luminaires with units of higher or lower wattage without Resident Engineer's approval.
 - 4. Retest as specified above after repairs, adjustments, or replacements are made.
 - 5. Report results in writing.
- D. Correction of Excessive Illumination in Spill-Light-Critical Areas: If measurements indicate that specified limits for spill light are exceeded, make corrections to illumination quantity, measured in field quality-control tests, that reduce levels to within specified maximum values.
 - 1. Replace luminaires; change mounting heights and revise aiming; or install louvers, shields, or baffles.

2. Obtain Resident Engineer's approval to replace luminaires with units of higher or lower wattage.
 3. If mounting height is changed, revise aiming and recalculate and modify or replace support structures if indicated.
 4. Retest as specified above after repairs, adjustments, or replacements are made.
 5. Report results in writing.
- E. Sports lighting will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

3.5 ADJUSTING

- A. Adjust luminaires and supports to maintain orientation and aiming as recommended by manufacturer.

END OF SECTION 265668

SUPPLEMENTARY SPECIAL PROVISIONS

APPENDICES

APPENDIX A
NOTICE OF EXEMPTION

NOTICE OF EXEMPTION

(Check one or both)

TO: X RECORDER/COUNTY CLERK
P.O. BOX 1750, MS A-33
1600 PACIFIC HWY, ROOM 260
SAN DIEGO, CA 92101-2422

FROM: CITY OF SAN DIEGO
PLANNING DEPARTMENT
1222 FIRST AVENUE, MS 501
SAN DIEGO, CA 92101

 OFFICE OF PLANNING AND RESEARCH
1400 TENTH STREET, ROOM 121
SACRAMENTO, CA 95814

PROJECT NO.: S-15003.02.06

PROJECT TITLE: PARK DE LA CRUZ GDP AMENDMENT

PROJECT LOCATION-SPECIFIC: The project is located at the existing Park de la Cruz Neighborhood Park, at 3901 Landis Street San Diego, CA 92105 which falls within the City Heights Community Plan area (Council District 9).

PROJECT LOCATION-CITY/COUNTY: San Diego/San Diego

DESCRIPTION OF NATURE AND PURPOSE OF THE PROJECT: MAYOR APPROVAL to allow for the renovations and improvements at the existing approximately 7-acre Park de la Cruz Neighborhood Park in City Heights. This includes landscape improvements to complete a linkage of “greenspace” to the existing Cherokee Point Park, with shade structures, picnic tables and seating, new shade and accent trees, enhancement of an existing YMCA building (interior tenant improvement and accessibility improvements), integration of a .41-acre skate park with primarily at-grade skate elements with bowls at approximately 5-foot and 9-foot depths, netting along the outfield fence of the existing ballfield up to approximately 30 feet in height, limited lighting, landscaped bioswale for storm water treatment, and Americans with Disabilities Act (ADA) accessibility and path of travel improvements. The project would not result in impacts to biological, paleontological or historical resources, is not located within or adjacent to the City’s Multi-Habitat Planning Area (MHPA), and is consistent with the Mid-City Community Plan.

NAME OF PUBLIC AGENCY APPROVING PROJECT: City of San Diego

NAME OF PERSON OR AGENCY CARRYING OUT PROJECT: City of San Diego, Public Works Department
Contact: Alexandra Corsi
525 B Street, Suite 750 (MS 908A)
San Diego, CA 92101
(619) 533-4644

EXEMPT STATUS:

- MINISTERIAL (SEC. 21080(b)(1); 15268);
- DECLARED EMERGENCY (SEC. 21080(b)(3); 15269(a));
- EMERGENCY PROJECT (SEC. 21080(b)(4); 15269 (b)(c))
- CATEGORICAL EXEMPTION: §15301 EXISTING FACILITIES and §15303 NEW CONSTRUCTION OR CONVERSION OF SMALL STRUCTURES
- STATUTORY EXEMPTION:

REASONS WHY PROJECT IS EXEMPT: The City of San Diego conducted an environmental review which determined that the park improvements meet the criteria set forth in State CEQA Guideline §15301 "Existing Facilities" which allows for minor alteration of existing structures, facilities, mechanical equipment, or topographical features and §15303 “New Construction or Conversion of Small Structures” which allows for the construction, location and modification of small facilities and structures; and where the exceptions listed in CEQA Section 15300.2 would not apply in that no cumulative impacts were identified; no significant effects on the environment were identified; the project is not adjacent to a scenic highway; no historical resources would be affected by the action, and the project was not identified on a list of hazardous waste sites pursuant to Section 65962.5 of the Government Code. Additionally, the project would not result in impacts to biological resources, and is not located in or adjacent to the City’s Multi-Habitat Planning Area (MHPA).

LEAD AGENCY CONTACT PERSON: MYRA HERRMANN

TELEPHONE: 619-446-5372

IF FILED BY APPLICANT:

1. ATTACH CERTIFIED DOCUMENT OF EXEMPTION FINDING.
2. HAS A NOTICE OF EXEMPTION BEEN FILED BY THE PUBLIC AGENCY APPROVING THE PROJECT?
() YES () NO

IT IS HEREBY CERTIFIED THAT THE CITY OF SAN DIEGO HAS DETERMINED THE ABOVE ACTIVITY TO BE EXEMPT FROM CEQA



SENIOR PLANNER

March 26, 2015

SIGNATURE/TITLE

DATE

CHECK ONE:

- (X) SIGNED BY LEAD AGENCY
() SIGNED BY APPLICANT

DATE RECEIVED FOR FILING WITH COUNTY CLERK OR OPR:



THE CITY OF SAN DIEGO

Date of Notice: March 26, 2015

NOTICE OF RIGHT TO APPEAL ENVIRONMENTAL DETERMINATION

PLANNING DEPARTMENT

WBS No. S-15003.02.06

PROJECT NAME/NUMBER: PARK DE LA CRUZ GDP AMENDMENT

COMMUNITY PLAN AREA: Mid-City (City Heights)

COUNCIL DISTRICT: 9

LOCATION: Park de la Cruz Neighborhood Park, at 3901 Landis Street San Diego, CA 92105

PROJECT DESCRIPTION: The project consists of renovations and improvements at the existing approximately 7-acre Park de la Cruz Neighborhood Park in City Heights. This includes landscape improvements to complete a linkage of "greenspace" to the existing Cherokee Point Park, with shade structures, picnic tables and seating, new shade and accent trees, enhancement of an existing YMCA building (interior tenant improvement and accessibility improvements), integration of a .41-acre skate park with primarily at-grade skate elements with bowls at approximately 5-foot and 9-foot depths, netting along the outfield fence of the existing ballfield up to approximately 30 feet in height, limited lighting, landscaped bioswale for storm water treatment, and Americans with Disabilities Act (ADA) accessibility and path of travel improvements. The project would not result in impacts to biological, paleontological or cultural resources, is not located within or adjacent to the City's Multi-Habitat Planning Area (MHPA), and is consistent with the Mid-City Community Plan.

ENTITY CONSIDERING PROJECT APPROVAL: City of San Diego Mayor-Appointed Designee

ENVIRONMENTAL DETERMINATION: Categorically exempt from CEQA pursuant to §15301 (a) Existing Facilities and §15303 New Construction or Conversion of Small Structures

ENTITY MAKING ENVIRONMENTAL DETERMINATION: City of San Diego Mayor-Appointed Designee

STATEMENT SUPPORTING REASON FOR ENVIRONMENTAL DETERMINATION: The City of San Diego conducted an environmental review which determined that the park improvements meet the criteria set forth in State CEQA Guideline §15301 "Existing Facilities" which allows for minor alteration of existing structures, facilities, mechanical equipment, or topographical features and §15303 "New Construction or Conversion of Small Structures" which allows for the construction, location and modification of small facilities and structures; and where the exceptions listed in CEQA Section 15300.2 would not apply in that no cumulative impacts were identified; no significant effects on the environment were identified; the project is not adjacent to a scenic highway; no historical

resources would be affected by the action, and the project was not identified on a list of hazardous waste sites pursuant to Section 65962.5 of the Government Code. Additionally, the project would not result in impacts to biological resources, and is not located in or adjacent to the City's Multi-Habitat Planning Area (MHPA).

PROJECT MANAGER:

Alexandra Corsi

MAILING ADDRESS:

525 B Street, Suite 750 (MS 908A)

San Diego, CA 92101

PHONE NUMBER:

(619) 533-4644

On March 26, 2015 the City of San Diego made the above-referenced environmental determination pursuant to the California Environmental Quality Act (CEQA). This determination is appealable to the City Council. If you have any questions about this determination, contact the City Development Project Manager listed above.

Applications to appeal CEQA determination made by staff (including the City Manager) to the City Council must be filed in the office of the City Clerk within 10 business days from the date of the posting of this Notice (**April 10, 2015**). The appeal application can be obtained from the City Clerk, 202 'C' Street, Second Floor, San Diego, CA 92101.

This information will be made available in alternative formats upon request.

POSTED IN THE OFFICE OF DSD	
Posted	<u>MAR 25 2015</u> <i>mu</i>
Removed	<u>APR 13 2015</u>
Posted by	<u><i>myralee</i></u>

APPENDIX B
FIRE HYDRANT METER PROGRAM

CITY OF SAN DIEGO CALIFORNIA DEPARTMENT INSTRUCTIONS	NUMBER DI 55.27	DEPARTMENT Water Department
SUBJECT FIRE HYDRANT METER PROGRAM (FORMERLY: CONSTRUCTION METER PROGRAM)	PAGE 1 OF 10	EFFECTIVE DATE October 15, 2002
	SUPERSEDES DI 55.27	DATED April 21, 2000

1. **PURPOSE**

1.1 To establish a Departmental policy and procedure for issuance, proper usage and charges for fire hydrant meters.

2. **AUTHORITY**

- 2.1 All authorities and references shall be current versions and revisions.
- 2.2 San Diego Municipal Code (NC) Chapter VI, Article 7, Sections 67.14 and 67.15
- 2.3 Code of Federal Regulations, Safe Drinking Water Act of 1986
- 2.4 California Code of Regulations, Titles 17 and 22
- 2.5 California State Penal Code, Section 498B.0
- 2.6 State of California Water Code, Section 110, 500-6, and 520-23
- 2.7 Water Department Director

Reference

- 2.8 State of California Guidance Manual for Cross Connection Programs
- 2.9 American Water Works Association Manual M-14, Recommended Practice for Backflow Prevention
- 2.10 American Water Works Association Standards for Water Meters
- 2.11 U.S.C. Foundation for Cross Connection Control and Hydraulic Research Manual

3. **DEFINITIONS**

3.1 **Fire Hydrant Meter:** A portable water meter which is connected to a fire hydrant for the purpose of temporary use. (These meters are sometimes referred to as Construction Meters.)

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3.2 **Temporary Water Use:** Water provided to the customer for no longer than twelve (12) months.

3.3 **Backflow Preventor:** A Reduced Pressure Principal Assembly connected to the outlet side of a Fire Hydrant Meter.

4. **POLICY**

4.1 The Water Department shall collect a deposit from every customer requiring a fire hydrant meter and appurtenances prior to providing the meter and appurtenances (see Section 7.1 regarding the Fees and Deposit Schedule). The deposit is refundable upon the termination of use and return of equipment and appurtenances in good working condition.

4.2 Fire hydrant meters will have a 2 ½" swivel connection between the meter and fire hydrant. The meter shall not be connected to the 4" port on the hydrant. All Fire Hydrant Meters issued shall have a Reduced Pressure Principle Assembly (RP) as part of the installation. Spanner wrenches are the only tool allowed to turn on water at the fire hydrant.

4.3 The use of private hydrant meters on City hydrants is prohibited, with exceptions as noted below. All private fire hydrant meters are to be phased out of the City of San Diego. All customers who wish to continue to use their own fire hydrant meters must adhere to the following conditions:

a. Meters shall meet all City specifications and American Water Works Association (AWWA) standards.

b. Customers currently using private fire hydrant meters in the City of San Diego water system will be allowed to continue using the meter under the following conditions:

1. The customer must submit a current certificate of accuracy and calibration results for private meters and private backflows annually to the City of San Diego, Water Department, Meter Shop.

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2. The meter must be properly identifiable with a clearly labeled serial number on the body of the fire hydrant meter. The serial number shall be plainly stamped on the register lid and the main casing. Serial numbers shall be visible from the top of the meter casing and the numbers shall be stamped on the top of the inlet casing flange.
3. All meters shall be locked to the fire hydrant by the Water Department, Meter Section (see Section 4.7).
4. All meters shall be read by the Water Department, Meter Section (see Section 4.7).
5. All meters shall be relocated by the Water Department, Meter Section (see Section 4.7).
6. These meters shall be tested on the anniversary of the original test date and proof of testing will be submitted to the Water Department, Meter Shop, on a yearly basis. If not tested, the meter will not be allowed for use in the City of San Diego.
7. All private fire hydrant meters shall have backflow devices attached when installed.
8. The customer must maintain and repair their own private meters and private backflows.
9. The customer must provide current test and calibration results to the Water Department, Meter Shop after any repairs.
10. When private meters are damaged beyond repair, these private meters will be replaced by City owned fire hydrant meters.

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11. When a private meter malfunctions, the customer will be notified and the meter will be removed by the City and returned to the customer for repairs. Testing and calibration results shall be given to the City prior to any re-installation.
 12. The register shall be hermetically sealed straight reading and shall be readable from the inlet side. Registration shall be in hundred cubic feet.
 13. The outlet shall have a 2 ½ “National Standards Tested (NST) fire hydrant male coupling.
 14. Private fire hydrant meters shall not be transferable from one contracting company to another (i.e. if a company goes out of business or is bought out by another company).
- 4.4 All fire hydrant meters and appurtenances shall be installed, relocated and removed by the City of San Diego, Water Department. All City owned fire hydrant meters and appurtenances shall be maintained by the City of San Diego, Water Department, Meter Services.
- 4.5 If any fire hydrant meter is used in violation of this Department Instruction, the violation will be reported to the Code Compliance Section for investigation and appropriate action. Any customer using a fire hydrant meter in violation of the requirements set forth above is subject to fines or penalties pursuant to the Municipal Code, Section 67.15 and Section 67.37.
- 4.6 **Conditions and Processes for Issuance of a Fire Hydrant Meter**
- Process for Issuance
- a. Fire hydrant meters shall only be used for the following purposes:
 1. Temporary irrigation purposes not to exceed one year.

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2. Construction and maintenance related activities (see Tab 2).
 - b. No customer inside or outside the boundaries of the City of San Diego Water Department shall resell any portion of the water delivered through a fire hydrant by the City of San Diego Water Department.
 - c. The City of San Diego allows for the issuance of a temporary fire hydrant meter for a period not to exceed 12 months (365 days). An extension can only be granted in writing from the Water Department Director for up to 90 additional days. A written request for an extension by the consumer must be submitted at least 30 days prior to the 12 month period ending. No extension shall be granted to any customer with a delinquent account with the Water Department. No further extensions shall be granted.
 - d. Any customer requesting the issuance of a fire hydrant meter shall file an application with the Meter Section. The customer must complete a "Fire Hydrant Meter Application" (Tab 1) which includes the name of the company, the party responsible for payment, Social Security number and/or California ID, requested location of the meter (a detailed map signifying an exact location), local contact person, local phone number, a contractor's license (or a business license), description of specific water use, duration of use at the site and full name and address of the person responsible for payment.
 - e. At the time of the application the customer will pay their fees according to the schedule set forth in the Rate Book of Fees and Charges, located in the City Clerk's Office. All fees must be paid by check, money order or cashiers check, made payable to the City Treasurer. Cash will not be accepted.
 - f. No fire hydrant meters shall be furnished or relocated for any customer with a delinquent account with the Water Department.
 - g. After the fees have been paid and an account has been created, the

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meter shall be installed within 48 hours (by the second business day). For an additional fee, at overtime rates, meters can be installed within 24 hours (within one business day).

4.7 Relocation of Existing Fire Hydrant Meters

- a. The customer shall call the Fire Hydrant Meter Hotline (herein referred to as "Hotline"), a minimum of 24 hours in advance, to request the relocation of a meter. A fee will be charged to the existing account, which must be current before a work order is generated for the meter's relocation.
- b. The customer will supply in writing the address where the meter is to be relocated (map page, cross street, etc). The customer must update the original Fire Hydrant Meter Application with any changes as it applies to the new location.
- c. Fire hydrant meters shall be read on a monthly basis. While fire hydrant meters and backflow devices are in service, commodity, base fee and damage charges, if applicable, will be billed to the customer on a monthly basis. If the account becomes delinquent, the meter will be removed.

4.8 Disconnection of Fire Hydrant Meter

- a. After ten (10) months a "Notice of Discontinuation of Service" (Tab 3) will be issued to the site and the address of record to notify the customer of the date of discontinuance of service. An extension can only be granted in writing from the Water Department Director for up to 90 additional days (as stated in Section 4.6C) and a copy of the extension shall be forwarded to the Meter Shop Supervisor. If an extension has not been approved, the meter will be removed after twelve (12) months of use.
- b. Upon completion of the project the customer will notify the Meter Services office via the Hotline to request the removal of the fire hydrant meter and appurtenances. A work order will be generated

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for removal of the meter.

- c. Meter Section staff will remove the meter and backflow prevention assembly and return it to the Meter Shop. Once returned to the Meter Shop the meter and backflow will be tested for accuracy and functionality.
- d. Meter Section Staff will contact and notify Customer Services of the final read and any charges resulting from damages to the meter and backflow or its appurtenance. These charges will be added on the customer's final bill and will be sent to the address of record. Any customer who has an outstanding balance will not receive additional meters.
- e. Outstanding balances due may be deducted from deposits and any balances refunded to the customer. Any outstanding balances will be turned over to the City Treasurer for collection. Outstanding balances may also be transferred to any other existing accounts.

5. **EXCEPTIONS**

- 5.1 Any request for exceptions to this policy shall be presented, in writing, to the Customer Support Deputy Director, or his/her designee for consideration.

6. **MOBILE METER**

- 6.1 Mobile meters will be allowed on a case by case basis. All mobile meters will be protected by an approved backflow assembly and the minimum requirement will be a Reduced Pressure Principal Assembly. The two types of Mobile Meters are vehicle mounted and floating meters. Each style of meters has separate guidelines that shall be followed for the customer to retain service and are described below:

- a) **Vehicle Mounted Meters:** Customer applies for and receives a City owned Fire Hydrant Meter from the Meter Shop. The customer mounts the meter on the vehicle and brings it to the Meter Shop for

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inspection. After installation is approved by the Meter Shop the vehicle and meter shall be brought to the Meter Shop on a monthly basis for meter reading and on a quarterly basis for testing of the backflow assembly. Meters mounted at the owner's expense shall have the one year contract expiration waived and shall have meter or backflow changed if either fails.

b) **Floating Meters:** Floating Meters are meters that are not mounted to a vehicle. **(Note: All floating meters shall have an approved backflow assembly attached.)** The customer shall submit an application and a letter explaining the need for a floating meter to the Meter Shop. The Fire Hydrant Meter Administrator, after a thorough review of the needs of the customer, (i.e. number of jobsites per day, City contract work, lack of mounting area on work vehicle, etc.), may issue a floating meter. At the time of issue, it will be necessary for the customer to complete and sign the "Floating Fire Hydrant Meter Agreement" which states the following:

- 1) The meter will be brought to the Meter Shop at 2797 Caminito Chollas, San Diego on the third week of each month for the monthly read by Meter Shop personnel.
- 2) Every other month the meter will be read and the backflow will be tested. This date will be determined by the start date of the agreement.

If any of the conditions stated above are not met the Meter Shop has the right to cancel the contract for floating meter use and close the account associated with the meter. The Meter Shop will also exercise the right to refuse the issuance of another floating meter to the company in question.

Any Fire Hydrant Meter using reclaimed water shall not be allowed use again with any potable water supply. The customer shall incur the cost of replacing the meter and backflow device in this instance.

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7. FEE AND DEPOSIT SCHEDULES

7.1 **Fees and Deposit Schedules:** The fees and deposits, as listed in the Rate Book of Fees and Charges, on file with the Office of the City Clerk, are based on actual reimbursement of costs of services performed, equipment and materials. These deposits and fees will be amended, as needed, based on actual costs. Deposits, will be refunded at the end of the use of the fire hydrant meter, upon return of equipment in good working condition and all outstanding balances on account are paid. Deposits can also be used to cover outstanding balances.

All fees for equipment, installation, testing, relocation and other costs related to this program are subject to change without prior notification. The Mayor and Council will be notified of any future changes.

8. UNAUTHORIZED USE OF WATER FROM A HYDRANT

8.1 Use of water from any fire hydrant without a properly issued and installed fire hydrant meter is theft of City property. Customers who use water for unauthorized purposes or without a City of San Diego issued meter will be prosecuted.

8.2 If any unauthorized connection, disconnection or relocation of a fire hydrant meter, or other connection device is made by anyone other than authorized Water Department personnel, the person making the connection will be prosecuted for a violation of San Diego Municipal Code, Section 67.15. In the case of a second offense, the customer's fire hydrant meter shall be confiscated and/or the deposit will be forfeited.

8.3 Unauthorized water use shall be billed to the responsible party. Water use charges shall be based on meter readings, or estimates when meter readings are not available.

8.4 In case of unauthorized water use, the customer shall be billed for all applicable charges as if proper authorization for the water use had been obtained, including but not limited to bi-monthly service charges, installation charges and removal charges.

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- 8.5 If damage occurs to Water Department property (i.e. fire hydrant meter, backflow, various appurtenances), the cost of repairs or replacements will be charged to the customer of record (applicant).

**Larry Gardner
Water Department Director**

- Tabs: 1. Fire Hydrant Meter Application
2. Construction & Maintenance Related Activities With No Return To Sewer
3. Notice of Discontinuation of Service

APPENDIX

Administering Division: Customer Support Division

Subject Index: Construction Meters
Fire Hydrant
Fire Hydrant Meter Program
Meters, Floating or Vehicle Mounted
Mobile Meter
Program, Fire Hydrant Meter

Distribution: DI Manual Holders



Application for Fire Hydrant Meter (EXHIBIT A)

(For Office Use Only)

METER SHOP (619) 527-7449

NS REQ	FAC#
DATE	BY

Meter Information

Application Date	Requested Install Date:
------------------	-------------------------

Fire Hydrant Location: (Attach Detailed Map//Thomas Bros. Map Location or Construction drawing.) Zip:	T.B.	G.B. (CITY USE)
Specific Use of Water:		
Any Return to Sewer or Storm Drain, If so, explain:		
Estimated Duration of Meter Use:		Check Box if Reclaimed Water

Company Information

Company Name:			
Mailing Address:			
City:	State:	Zip:	Phone: ()
*Business license#		*Contractor license#	
A Copy of the Contractor's license OR Business License is required at the time of meter issuance.			
Name and Title of Billing Agent: (PERSON IN ACCOUNTS PAYABLE)			Phone: ()
Site Contact Name and Title:			Phone: ()
Responsible Party Name:			Title:
Cal ID#			Phone: ()
Signature:		Date:	
Guarantees Payment of all Charges Resulting from the use of this Meter. Insures that employees of this Organization understand the proper use of Fire Hydrant Meter			

Fire Hydrant Meter Removal Request	Requested Removal Date:
Provide Current Meter Location if Different from Above:	
Signature:	Title: Date:
Phone: ()	Pager: ()

<input type="checkbox"/> City Meter	<input type="checkbox"/> Private Meter
Contract Acct #:	Deposit Amount: \$ 936.00 Fees Amount: \$ 62.00
Meter Serial #	Meter Size: 05 Meter Make and Style: 6-7
Backflow #	Backflow Size: Backflow Make and Style:
Name:	Signature: Date:

WATER USES WITHOUT ANTICIPATED CHARGES FOR RETURN TO SEWER

Auto Detailing
Backfilling
Combination Cleaners (Vactors)
Compaction
Concrete Cutters
Construction Trailers
Cross Connection Testing
Dust Control
Flushing Water Mains
Hydro Blasting
Hydro Seeing
Irrigation (for establishing irrigation only; not continuing irrigation)
Mixing Concrete
Mobile Car Washing
Special Events
Street Sweeping
Water Tanks
Water Trucks
Window Washing

Note:

1. If there is any return to sewer or storm drain, then sewer and/or storm drain fees will be charges.

Date

Name of Responsible Party
Company Name and Address
Account Number: _____

Subject: Discontinuation of Fire Hydrant Meter Service

Dear Water Department Customer:

The authorization for use of Fire Hydrant Meter # _____, located at *(Meter Location Address)* ends in 60 days and will be removed on or after *(Date Authorization Expires)*. Extension requests for an additional 90 days must be submitted in writing for consideration 30 days prior to the discontinuation date. If you require an extension, please contact the Water Department, or mail your request for an extension to:

City of San Diego
Water Department
Attention: Meter Services
2797 Caminito Chollas
San Diego, CA 92105-5097

Should you have any questions regarding this matter, please call the Fire Hydrant Hotline at (619) _____ - _____.

Sincerely,

Water Department

APPENDIX C

MATERIALS TYPICALLY ACCEPTED BY CERTIFICATE OF COMPLIANCE

Materials Typically Accepted by Certificate of Compliance

1. Soil amendment
2. Fiber mulch
3. PVC or PE pipe up to 16 inch diameter
4. Stabilizing emulsion
5. Lime
6. Preformed elastomeric joint seal
7. Plain and fabric reinforced elastomeric bearing pads
8. Steel reinforced elastomeric bearing pads
9. Waterstops (Special Condition)
10. Epoxy coated bar reinforcement
11. Plain and reinforcing steel
12. Structural steel
13. Structural timber and lumber
14. Treated timber and lumber
15. Lumber and timber
16. Aluminum pipe and aluminum pipe arch
17. Corrugated steel pipe and corrugated steel pipe arch
18. Structural metal plate pipe arches and pipe arches
19. Perforated steel pipe
20. Aluminum underdrain pipe
21. Aluminum or steel entrance tapers, pipe downdrains, reducers, coupling bands and slip joints
22. Metal target plates
23. Paint (traffic striping)
24. Conductors
25. Painting of electrical equipment
26. Electrical components
27. Engineering fabric
28. Portland Cement
29. PCC admixtures
30. Minor concrete, asphalt
31. Asphalt (oil)
32. Liquid asphalt emulsion
33. Epoxy

APPENDIX D

SAMPLE CITY INVOICE

City of San Diego, Field Engineering Div., 9485 Aero Drive, SD CA 92123		Contractor's Name:	
Project Name:		Contractor's Address:	
Work Order No or Job Order No.			
City Purchase Order No.		Contractor's Phone #:	Invoice No.
Resident Engineer (RE):		Contractor's fax #:	Invoice Date:
RE Phone#:	Fax#:	Contact Name:	Billing Period: (to

Item #	Item Description	Contract Authorization				Previous Totals To Date		This Estimate		Totals to Date	
		Unit	Price	Qty	Extension	%/QTY	Amount	% / QTY	Amount	% / QTY	Amount
1					\$ -		\$ -		\$ -	0.00%	\$ -
2					\$ -		\$ -		\$ -	0.00%	\$ -
3					\$ -		\$ -		\$ -	0.00%	\$ -
4					\$ -		\$ -		\$ -	0.00%	\$ -
5					\$ -		\$ -		\$ -	0.00%	\$ -
6					\$ -		\$ -		\$ -	0.00%	\$ -
7					\$ -		\$ -		\$ -	0.00%	\$ -
8					\$ -		\$ -		\$ -	0.00%	\$ -
9					\$ -		\$ -		\$ -	0.00%	\$ -
10					\$ -		\$ -		\$ -	0.00%	\$ -
11					\$ -		\$ -		\$ -	0.00%	\$ -
12					\$ -		\$ -		\$ -	0.00%	\$ -
13					\$ -		\$ -		\$ -	0.00%	\$ -
14					\$ -		\$ -		\$ -	0.00%	\$ -
15					\$ -		\$ -		\$ -	0.00%	\$ -
16					\$ -		\$ -		\$ -	0.00%	\$ -
17	Field Orders				\$ -		\$ -		\$ -	0.00%	\$ -
18					\$ -		\$ -		\$ -	0.00%	\$ -
	CHANGE ORDER No.				\$ -		\$ -		\$ -	0.00%	\$ -
					\$ -		\$ -		\$ -	0.00%	\$ -
Total Authorized Amount (including approved Change Order)					\$ -		\$ -		\$ -	Total Billed	\$ -

SUMMARY

A. Original Contract Amount	\$ -
B. Approved Change Order #00 Thru #00	\$ -
C. Total Authorized Amount (A+B)	\$ -
D. Total Billed to Date	\$ -
E. Less Total Retention (5% of D)	\$ -
F. Less Total Previous Payments	\$ -
G. Payment Due Less Retention	\$0.00
H. Remaining Authorized Amount	\$0.00

**I certify that the materials
have been received by me in
the quality and quantity specified**

Resident Engineer

Construction Engineer

Retention and/or Escrow Payment Schedule

Total Retention Required as of this billing (Item E)	\$0.00
Previous Retention Withheld in PO or in Escrow	\$0.00
Add'l Amt to Withhold in PO/Transfer in Escrow:	\$0.00
Amt to Release to Contractor from PO/Escrow:	

Contractor Signature and Date: _____

APPENDIX E
LOCATION MAP

PREDESIGN LOCATION MAP MID - CITY SKATE PARK

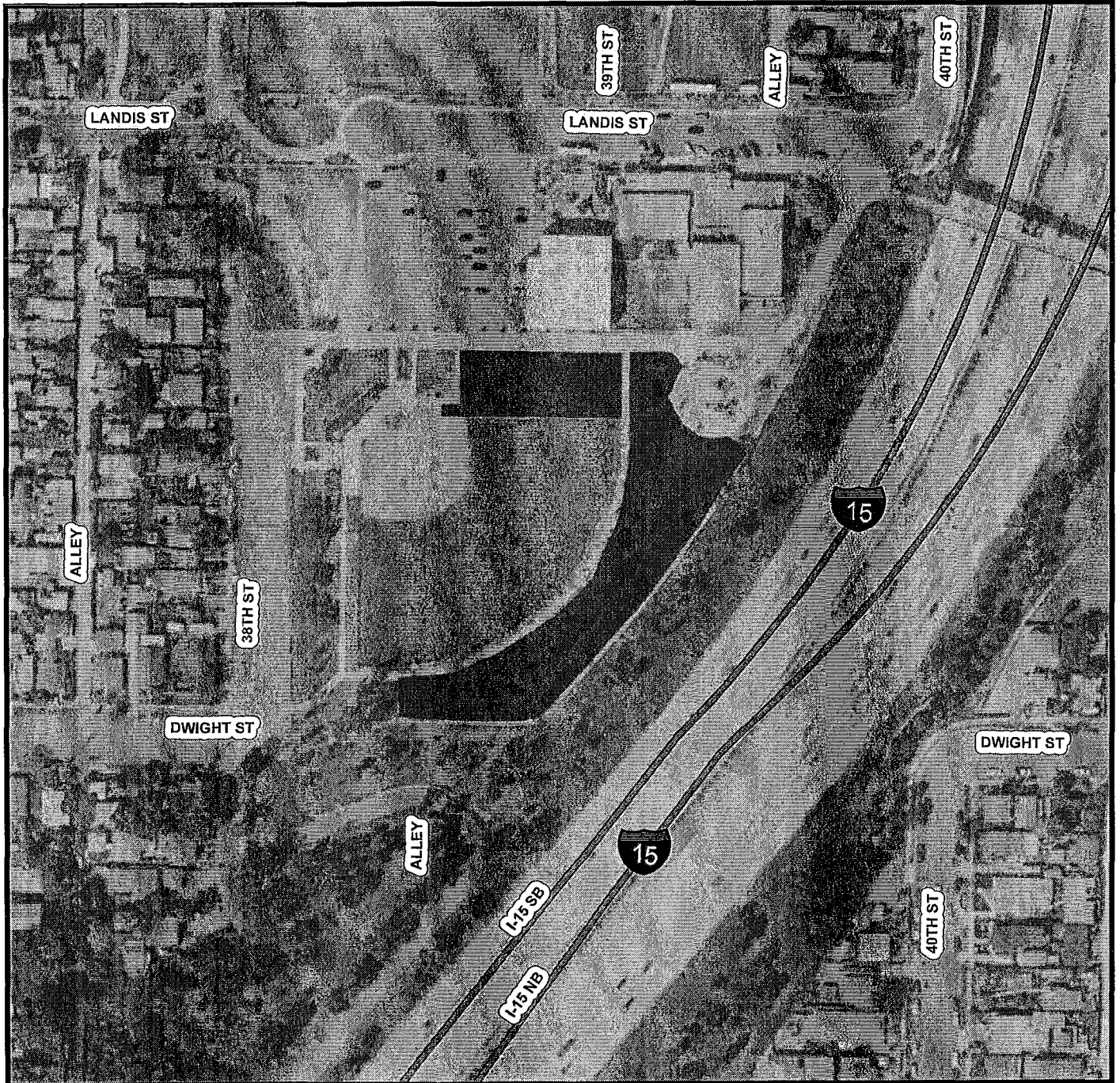
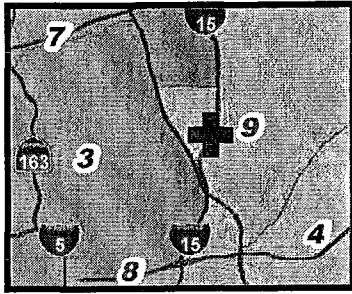


PREDESIGN SENIOR ENGINEER
NEVIEN ANTOUN
619-533-4852

PREDESIGN PROJECT
MANAGER
LARRY KUZMINSKY
619-533-3065

PROJECT IMPLEMENTATION SECTION (PI)
CIP PRELIMINARY ENGINEERING & PROGRAM COORDINATION

PREDESIGN DRAFTER
SUSAN GRIEBENOW
619-533-3652



Legend

 Project Location



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APPENDIX F

SOILS INVESTIGATION, DATED DECEMBER 10, 2014

**SOILS INVESTIGATION
PROPOSED
MID CITY SKATE PARK
DWIGHT STREET AND 38TH STREET
SAN DIEGO, CALIFORNIA**

(K2 Engineering Job No. G2014015-1)

Prepared for:

Schmidt Design Group

December 10, 2014





December 10, 2014

Mr. Jeff Justus
Schmidt Design Group
1111 Sixth Avenue, Suite 500
San Diego, CA 92101

(K2 Engineering Job No. G2014015-1)

Dear Mr. Justus:

We are pleased to submit our report of "Soils Investigation, Proposed Mid City Skate Park, San Diego, California."

The results of our field explorations and laboratory tests, along with recommendations for earthwork and for design of the proposed park improvements are presented in this report.

Please call us if you have any questions or if we can be of further service to you on this or future projects. It has been a pleasure working with you.

Respectfully submitted,

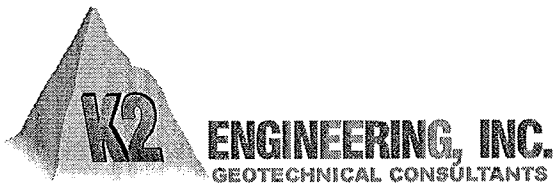
K2 ENGINEERING, INC.

A handwritten signature in cursive script, appearing to read 'Susana Kemmerrer'.

Susana Kemmerrer, RGE 2287
President



K2/Reports/SCHMIDT DESIGN/Mid City Skate Park G2014015-1 Final.doc



SOILS INVESTIGATION
PROPOSED
MID CITY SKATE PARK
DWIGHT STREET AND 38TH STREET
SAN DIEGO, CALIFORNIA

(K2 Engineering Job No. G2014015-1)

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Appendix B Supplemental Recommendations - Light Fixture Foundations

1.0 SUMMARY

This report presents the results of our soils investigation performed to provide earthwork and foundation recommendations for the proposed Mid City Skate Park. The skate park is planned within the existing Park De La Cruz located northeast of the intersection of 38th and Dwight Streets in San Diego, California. The locations of the exploratory excavations performed are presented on Plate 1, Site Plan. A summary of our findings and recommendations is presented below.

- Fill soils extending to the maximum depth explored of 14 feet were encountered at the boring locations. The fill soils were medium dense to dense with abundant gravel and cobbles. The fill soils were reportedly placed during mass grading of the site associated with the construction of the I-15 Freeway to the east. Documentation regarding fill placement was not available for review.
- Groundwater was not encountered in the exploratory borings.
- At their present condition, the existing fill soils are not considered suitable for support of the proposed facilities without improvement. To provide more uniform support, we recommend that the existing fill soils be overexcavated and replaced as compacted fill. The proposed improvements may then be supported on compacted fill. Spread footings established on compacted fill may be used for support of the proposed improvements.
- To reduce the potential for damage due to settlement, subgrade stabilization using geogrid reinforcement and/or gravel may be required beneath the bowls.
- Percolation testing performed on site indicated very slow to moderately slow percolation rates.

- oOo -

2.0 SCOPE

This report presents the results of a soils investigation performed to provide planning and design criteria for the proposed Mid City Skate Park in San Diego, California. The approximate locations of the exploratory excavations are presented in Plate 1, Site Plan.

The purpose of this investigation was to determine the static physical characteristics of the on-site soils; and to provide geotechnical recommendations for foundation design, grading, excavation and backfill for the proposed facilities. More specifically, the scope of the investigation included the following:

- Evaluation of the existing surface and subsurface conditions, including groundwater conditions (if encountered), within the areas of proposed construction.
- Drilling and logging of three borings to a maximum depth of 20 feet or to refusal.
- Performing two percolation tests to evaluate the permeability of the on-site soils.
- Laboratory tests to estimate the physical properties of the onsite materials.
- Providing recommendations for grading.
- Providing recommended foundation systems together with the associated design parameters.
- Presenting general recommendations concerning construction procedures and quality control measures relating to earthwork.

Our recommendations are based on the results of our field explorations, laboratory tests and associated geotechnical analyses. The results of our field explorations and laboratory tests are presented in Appendix A. This investigation did not include studies to assess the environmental hazards that may affect the site however, this does not imply that such hazards affect the site.

Our professional services have been performed using that degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical consultants practicing in this or similar localities. No other warranty, express or implied, is made as to the professional advice included in this report. This report has been prepared for Schmidt Design Group and their design consultants to be used solely in the evaluation of the subject project. The report has not been prepared

for use by other parties, and may not contain sufficient information for purposes of other parties or other uses.

3.0 PROJECT DESCRIPTION

The proposed Mid City Skate Park will be located within the existing Park De La Cruz northeast of the intersection of 38th and Dwight Streets, in San Diego, California. According to available information, the proposed park will include a variety of street and vertical features including obstacles, banks and bowls of various depths spread along the length of the project. Vegetated storm water drainage swales are also planned.

With the exception of the bowl features, which may require excavations of up to 9 feet, it is anticipated that the park will be established at about the existing grade. We understand that no building structures are planned at this time.

4.0 SITE CONDITIONS

4.1 EXISTING CONDITIONS

The site is located northeast of the intersection of 38th and Dwight Streets. The proposed skate park site is bound to the west by an existing baseball field, to the north by the Copley Family YMCA and to the east by the Escondido Freeway. According to current plans the proposed skate park will be about 1.25 acres and will encompass the grass area outside the baseball field. The site is relatively flat with numerous large trees and a concrete walkway bordering the baseball field fence.

According to the available information, the site was graded during the mass grading associated with the Escondido Freeway by cutting and filling the previously existing topography.

4.2 SUBSURFACE CONDITIONS

The subsurface conditions were explored by drilling three small-diameter borings extending to depths of 5 to 14 feet below the existing ground surface. In addition, two percolation test holes were excavated to depths of approximately 3 feet. Fill soils extending to the maximum depth explored of 14 feet were encountered in all of the exploratory excavations. The fill soils consisted of medium dense to dense, moist, silty sand with abundant gravel and cobbles. Pieces of concrete were encountered in one of the borings. Refusal in a gravel and cobble layers was encountered at depths of 4 to 14 feet in the exploratory borings.

The fill soils were reportedly placed during rough grading of the area. The composition of the fill, fill depth or the degree of compaction are not known. Documentation regarding earthwork performed during grading of the site was not available for review. Deeper and/or poorer quality fills including the presence of oversized rocks or construction debris may be encountered.

Groundwater was not encountered within any of the borings or percolation test pits to the depths explored. However, groundwater conditions could develop and/or seepage may occur depending on annual precipitation and irrigation. Seepage may occur along lithologic changes within the on-site soils and at the interface between the fill and the less permeable formational materials.

5.0 PERCOLATION TESTS

Two percolations tests were performed to evaluate the infiltration characteristics of the on-site materials and to provide information for the design of the proposed water retention facilities. The approximate percolation test locations are presented on Plate 1, Site Plan.

The percolation tests were performed in accordance with the general guidelines of the San Diego County Public Health Department. The results of the tests are presented in Table 1, Percolation Test Results. The tests results are indicative of the permeability of the on-site soils at their current condition. Percolation rates will be affected by future construction activity such as earthmoving and compaction.

The percolation tests consisted of drilling two 8-inch diameter test holes extending to a depth of approximately 3 feet on October 28, 2014. A minimum of 12 inches of clean water was carefully poured into the percolation holes and presoaked for a minimum of 6 hours. At the end of the presoaking, water was left in the holes overnight.

Percolation testing was performed on October 29, 2014. Saturated soil (mud) and caving of the side walls to depths of 12 to 18 inches was observed prior to start of the percolation tests. The loose materials were removed and about 6 inches of pea gravel was added to the bottom of the holes. Clean water was added to each of the holes and the variations in the water level were measured at approximate 30 minute intervals for a total of four hours for PMC-1. Readings in PMC-2 were stopped after 2 hours when no change in water level was recorded on four consecutive readings. Refilling of the holes was performed as needed to maintain the water level at the start of each interval. The average of the last three 30-minute interval readings was used to determine the percolation rate. The percolation test results indicate a range of percolation rates of about 0 to 87 minutes per inch (mpi). According to the USDA the soils are considered to have a very slow to moderately slow flow rate.

Table 1, Percolation Test Results

Test Number	Percolation Rate (min/inch)	Permeability (in/hr)	Rate of Flow⁽¹⁾
PMC-1	87	0.69	Moderately Slow
PMC-2	Did not percolate	0	Very Slow

⁽¹⁾Based on USDA Soil Survey Glossary

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 GENERAL

At the locations drilled, the fill soils consist of medium dense to dense silty sand with abundant gravel and cobbles. Some pieces of concrete were encountered in one of the borings.

The fill soils within the site were reportedly placed during mass grading operations associated with the construction of the Escondido Freeway. The fill characteristics including depth, degree of compaction and composition are not known. It is possible that oversized materials, including construction debris, were placed within the fill. Documentation regarding fill placement was not available for review. Additional studies will be required if future structures are planned.

We understand that the proposed park improvements will be established at about the existing grade. No significant cuts and/or fills are planned. Excavations of up to 9 feet may be required for some of the proposed bowl features.

To provide more uniform support and to reduce the potential for damage due to differential movement, we recommend that the fill soils be overexcavated and replaced as compacted fill soils. As an alternative to complete removal and replacement, if the risk of some settlement is acceptable, the existing fill soils may be overexcavated to allow the placement of at least 3 feet of compacted fill beneath the proposed bowls. Overexcavation should extend at least 5 feet beyond the limits to the bowl(s) or footings. To provide more uniform support or if soft or loose materials are encountered at the overexcavated depth, geogrid layers within the compacted fill and/or a 1-foot layer of gravel may be required.

Beneath paved and/or hardscaped areas a minimum of overexcavation depth of 2 feet below the finished subgrade is recommended.

6.2 FOUNDATIONS

6.2.1 Bearing Value

To provide more uniform support, we recommend that footings extend at least 1½ feet below the lowest adjacent final grade. A bearing value of 2,000 pounds per square foot may be used for footings at least 12 inches in width and supported on at least 2 feet of compacted fill soils. A modulus of subgrade reaction of 200 pounds per cubic inch may be used when designing a mat foundation supported on compacted fill.

A one-third increase in the bearing value may be used for wind or seismic loads. Since the recommended bearing value is a net value, the weight of the concrete in the footings may be taken as equal to 50 pounds per cubic foot, and the weight of the soil backfill may be neglected.

6.2.2 Settlement

If the footings are supported on non-expansive fill that is compacted in accordance with this report, the total settlement is estimated to be within acceptable limits for the proposed improvements.

6.2.3 Lateral Loads

Lateral loads may be resisted by friction and by the passive resistance of the non-expansive compacted fill soils beneath the footings. A coefficient of friction of 0.40 may be used between the foundations and the supporting materials. The passive resistance of the compacted fill soils may be assumed to be equal to the pressure developed by an equivalent fluid with a density of 350 pounds per cubic foot. The frictional resistance and the passive resistance of the materials may be combined without reduction in determining the total lateral resistance.

6.2.4 Footing Observation

To verify that footings are supported in accordance with our recommendations, all foundation excavations should be observed by a qualified geotechnical firm. Foundations should be deepened if necessary to reach satisfactory bearing materials. Any unsuitable materials including, undocumented fill, organic, loose or disturbed natural materials should be removed prior to placement of any steel or concrete.

All applicable requirements of the local governing bodies, the Occupational Safety and Health Act of 1970, and the Construction Safety Act should be met. Inspection of footing excavations may be required by the appropriate reviewing governmental agencies. The contractor should familiarize himself with the inspection requirements of the reviewing agencies.

6.2.5 Backfill

All required fill around the foundations and all utility trench backfill should be mechanically compacted in layers, not more than 8 inches in loose thickness; flooding should not be permitted. Backfill should be moisture-conditioned to a minimum 2% over the optimum moisture content and be compacted to at least 90% of the maximum density obtainable by ASTM Designation D1557-12 method of compaction. The exterior grades should be graded to drain away from the structures in order to reduce ponding of water adjacent to structures.

Compaction of the backfill as recommended in this report will be necessary to reduce settlement of the backfill and consequent settlement of the overlying improvements and buried utilities. Even at 90% compaction (ASTM D1557-12), some settlement of the backfill may be anticipated. Accordingly, any utilities supported therein should be designed to accept differential settlement, particularly at connection points to the structure.

In order to reduce the amount of backfill required, the foundations may be cut neat and poured against the excavated fill soils.

6.3 EXCAVATION

Temporary unsurcharged vertical excavations less than 5 feet in height may be excavated without shoring. Where the necessary space is available, temporary unsurcharged excavations may be sloped back in lieu of using shoring. Temporary unsurcharged excavations may be sloped back at 1:1 (horizontal to vertical). The exposed excavations should be observed by a competent geotechnical firm so that modifications of the excavation criteria may be made if necessary. All applicable requirements of the local governments, the Occupational Safety and Health Act of 1970, and the Construction Safety Act should be met. Conventional earth moving/excavation equipment may be used to excavate the on-site materials.

6.4 GRADING

6.4.1 General

According to the available information, the site was graded by cutting and filling into the previously existing topography. At the boring locations, the fill soils consist of medium dense to dense silty sand with abundant gravel and cobbles.

To provide more uniform support, we recommend that the on-site soils be overexcavated and replaced as compacted fill soils. Overexcavation and replacement should extend to at least 3 feet below the bottom of the bowl features and at least 5 feet beyond the edge of the bowl. Compacted fill should be placed within a 1 to 1 plane (active wedge) extending from the bottom of the excavation. A schematic representation of the recommended excavation is presented in Figure 1, Bowl Excavation.

Footings should be underlain by at least 2 feet of compacted fill. The removal should extend at least 5 feet beyond the edge of footings. A minimum of 2 feet of compacted fill are recommended beneath pavements, slabs and sidewalks.

To reduce moisture infiltration beneath the proposed features, site drainage should be provided. Finished grades should be sloped to drain away from the structures.

6.4.2 Site Preparation and Compaction

Prior to placement of any new fill, the existing fill soils should be overexcavated to a minimum depth of 3 feet below the bottom of the proposed bowls. Removal in other areas should extend to a minimum depth of 2 feet beneath the proposed finished subgrade. Prior to fill placement, the exposed materials should be proof-rolled to disclose any soft and/or yielding areas. Any soft and/or yielding areas or expansive soils should be removed and replaced with non-expansive compacted fill. After removal of unsuitable materials, the exposed soils should be scarified to a depth of 8 inches, moisture conditioned and compacted to at least 90% of the maximum dry density (ASTM D1557-12).

After removal of unsuitable materials, all required non-expansive fill should be placed in loose lifts not more than 8 inches thick. Any new fill should be compacted to at least 90% of the maximum dry density (ASTM D1557-12). The moisture content of the imported non-expansive soils should be maintained within 2% of optimum moisture content during compaction.

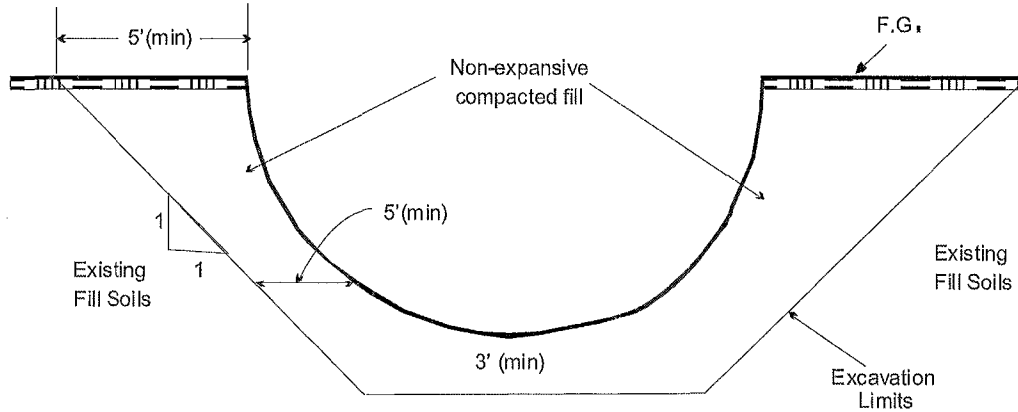


Figure 1, Bowl Excavation

The use of geogrid layers and/or a gravel layer at least 12 inches in thickness may be required if loose and/or unconsolidated materials are encountered at the bottom of the excavations beneath the bowls. A qualified geotechnical firm should observe the exposed materials to verify the complete removal of unsuitable deposits.

6.4.3 Material for Fill

The on-site soils have a very low expansion potential. These soils less any debris, organic matter, contaminated soils, and rocks greater than 6 inches in maximum dimension may be used in the required fills. Expansive clayey soils (Expansion Index greater than 21) should not be used as fill beneath structures, pavements or landscaped areas.

If required, imported fill soils should consist of relatively non-expansive soils with an Expansion Index of less than 21, an angle of internal friction of at least 33°, and a minimum R-value of 50. The material should contain sufficient fines (binder material) to result in a stable subgrade.

6.4.4 Grading Observation

The reworking of the upper soils and the compaction of all required fill should be observed and tested by a qualified geotechnical engineering firm. Imported fill material should be approved prior to use as fill. Modifications to the grading recommendations may be required.

6.5 SEISMIC DESIGN PARAMETERS

The materials beneath the site consist of medium dense to dense silty sand. Based on the results of the field explorations and geologic evaluation, stiff soil classification "D" was assigned to the site. The coordinates of the proposed park are N32.7445° and W117.1107°.

The design of the proposed structures should be performed in accordance with the codes and regulations appropriate to the project. As such we are providing the seismic design parameters in accordance with the 2012 International Building Code (IBC).

In accordance with Section 1613 of the 2012 IBC Guidelines for New Buildings and Other Structures, the following design parameters may be used for design of the proposed improvements.

$S_s = 104\% g$ Maximum Considered Ground Motion for 0.2 second Spectral Response Acceleration, 5% of Critical Damping, Site Class B

$S_1 = 39\% g$ Maximum Considered Ground Motion for 1.0 second Spectral Response Acceleration, 5% of Critical Damping, Site Class B

The following spectral acceleration factors may be used to develop the response spectra for the deterministic Maximum Considered Earthquake.

$$F_a = 1.08$$

$$F_v = 1.6$$

$$S_{ms} = F_a S_s$$

$$S_{m1} = F_v S_1$$

6.6 WALLS BELOW GRADE

6.6.1 Lateral Pressures

Backfill materials for all walls below grade should consist of non-expansive fill soil as defined in the grading section. Compacted fill should be placed within active wedge defined as a 1 to 1 plane extending upwards from the bottom of the wall or footing. A minimum compacted fill thickness of 5 feet is recommended on all sides of the structure as noted in Figure 1.

For design of cantilevered retaining walls with heights of 15 feet or less, where the backfill consists of non-expansive granular materials and the surface of backfill is level and well drained, it may be assumed that the non-expansive soils will exert lateral pressures equal to that developed by a fluid with a density of 35 pounds per cubic foot. Where wall rotation or movement is not acceptable, we recommend that the walls below grade be designed for "at rest" pressures. When considering "at rest" pressures where the surface of the retained earth is level it may be assumed that the soils will exert an equivalent fluid pressure of 55 pounds per cubic foot.

In addition to the recommended earth pressure, the upper 10 feet of the below grade walls adjacent to roads should be designed to resist a uniform lateral pressure of 100 pounds per square foot. If all traffic is kept back at least 10 feet from the edge of the walls, the traffic surcharge may be neglected.

6.6.2 Backfill

All required backfill should be mechanically compacted in layers not more than 8 inches in loose thickness; flooding should not be permitted. Compaction of the backfill as recommended will be necessary to reduce settlement of the backfill and of overlying slabs, walks, and paving and to reduce infiltration of surface water into the backfill. The backfill should be compacted to at least 90% of the maximum density obtainable by the ASTM Designation D1557-12 method of compaction.

6.6.3 Drainage

If the backfill is placed and compacted as recommended and good surface drainage is provided, infiltration of water into the backfill adjacent to the proposed walls below grade and retaining walls should be small. To reduce the potential for water entrapment, surface and subsurface drains behind all walls are recommended.

Weep holes, backdrains, or other drainage measures should be provided in retaining walls and walls below grade to reduce the potential for entrapment of water in the backfill behind the walls. Adequate drainage of adjacent planters should be provided to prevent water infiltration into wall backfills. Drainage could consist of vertical gravel drains about 12 inches wide connected to a 4-inch-diameter perforated pipe. The perforated pipe should be surrounded by at least 1 foot of filter gravel (or uniformly graded gravel or Class II permeable material) wrapped in a geosynthetic filter fabric, such as Mirafi 140 N.S. The drain pipe should be located near the base of the wall and should discharge in a controlled manner away from the proposed structures. As an alternative to the vertical gravel drains, a drainage geocomposite such as Miradrain may be used.

6.7 SLOPES AND EROSION CONTROL

Minor slopes may be constructed to accommodate the skating features. To reduce the potential for erosion of the proposed slope faces, permanent erosion control and drainage devices should be provided as soon as feasible after grading. Slope erosion, including sloughing, riling and slumping of surface soils may be anticipated if the slopes are left unprotected for a long period of time, especially during the rainy season. Erosion control may include, but may not be limited to: erosion resistant vegetation and/or erosion control geofabrics. Slopes should be planted with appropriate drought-resistant vegetation as recommended by a landscape architect. Slopes should not be over-irrigated.

Drainage devices designed to carry surface water from overlying areas should not be blocked or destroyed, and should be maintained regularly. Water should be prevented from ponding in pad areas, or from overtopping and flowing down graded or natural slopes. Concrete drainage swales should be installed at a minimum at the top of the slopes to prevent surface runoff over the top of the slope and to reduce the erosion at the face and toe of the slope.

Animal burrows can serve to collect normal sheet flow on slopes and cause rapid and destructive erosion, and should be controlled or eliminated.

6.8 CONCRETE FLATWORK

A minimum thickness of 4 inches is recommended for all concrete walks and slabs. Flatwork reinforcement should consist of a minimum No. 3 bars with an 18-inch spacing in both directions and placed at slab mid-height. Final reinforcement configuration should be provided by the structural engineer. All concrete slabs should be underlain by at least 2 feet of non-expansive compacted fill soils. A minimum 28-day concrete compressive strength of 2,500 pounds per square inch is recommended for pedestrian sidewalks and other non-traffic hardscaped areas.

Weakened plane joints should be placed in sidewalks at intervals that are no greater than 15 feet on center. Weakened plane joints should be at least 1-inch deep. Full depth construction joints should be placed at 45 feet intervals. Rectangular patio areas should have weakened plane joints at 10 feet on center in both directions. Expansion joint material should be placed adjacent to any vertical surfaces (walls, buildings or columns).

6.9 PAVING

Tests performed on a sample of the on-site soils indicated an R-value of 55. The test results are presented in the Appendix.

To provide support for paving, the subgrade soils should be prepared as recommended in the previous sections on Grading. Compaction of the subgrade to at least 90%, including trench backfills, will be important for paving support.

For purposes of pavement design, it was assumed that the on-site soils compacted as recommended in this report, will be used as the supporting subgrade. The pavement thickness should be confirmed prior to construction so that any required modifications may be made based on the actual fill materials to be used.

A Traffic Index of 5 was assumed for design of the proposed pavements. The assumed traffic includes automobile and light truck traffic such as the maintenance trucks. If heavy trucks, such as fire trucks are anticipated the pavement sections should be revised to include the heavier loads.

In completing the design we have assumed that the portland cement concrete (p.c.c.) pavement will have a 28-day flexural strength of 650 pounds per square inch or a compressive strength of at least 4,000 pounds per square inch. Our design also assumes that the on-site materials or imported materials with a minimum R-value of 55, with an equivalent Modulus of Subgrade Reaction (k) of 200 pounds per cubic inch will be used for support.

Table 2, Portland Cement Concrete Pavement

Traffic Index	Subgrade	Paving Section*
5 (Automobile and light truck traffic)	Non-expansive compacted fill	6½" p.c.c

*City of San Diego Standard Drawings

7.0 SOIL CORROSIVITY

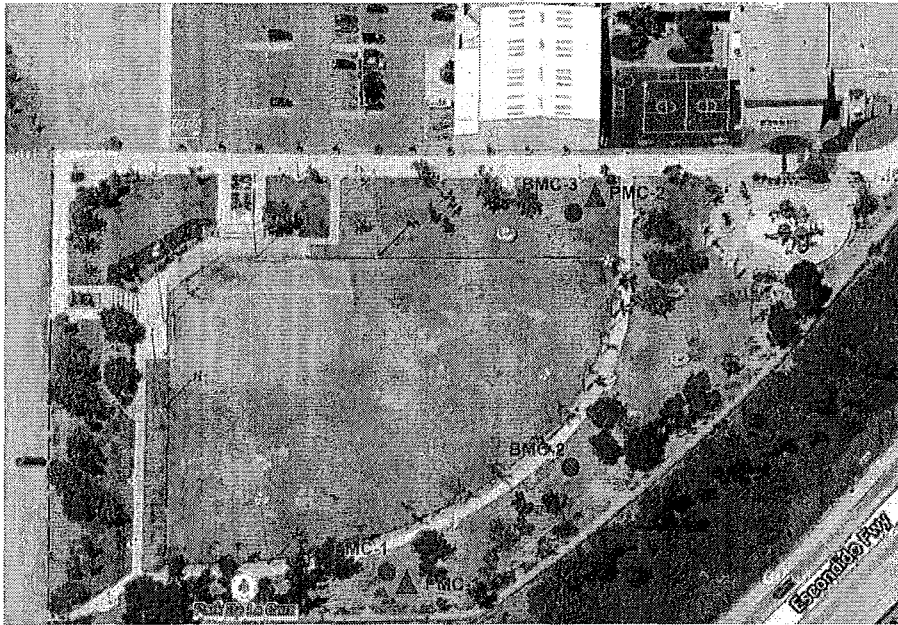
Based on the laboratory test results, the on-site soils have low sulfate ion concentrations (140 parts per million (ppm) and low concentrations of chloride ions (70 ppm). The test results are presented on Plate A-8, Corrosion Test Data. Therefore Type I, II or V cement may be used during construction. Concrete should be thoroughly vibrated. Laboratory tests show a moderate to severe resistivity value (2,000 ohm-cm), indicating a severe potential for metal loss due to electrochemical corrosion processes. Therefore, a minimum concrete cover of 3 inches should be provided over all re-bar, anchor bolts or metallic embeds placed within the foundations and to 18 inches above the ground surface. Reinforcing steel should be protected with a concrete cover of at least 1½ inches for formed surfaces not exposed to weather or not in contact with the ground. If the minimum cover is not achieved corrosion protection of steel members such as epoxy or asphalt coatings may be used. **We recommend that a corrosion engineer be consulted for final corrosion protection recommendations.**

8.0 BASIS FOR RECOMMENDATIONS

The recommendations provided in this report are based on our understanding of the described project information and on our interpretation of the data collected during the subsurface exploration. We have made our recommendations based on experience with similar subsurface conditions under similar loading conditions. The recommendations apply to the specific project discussed in this report; therefore, any change in the facility loads, expected traffic conditions, facility location, or site grades shall be provided to us so we may review our conclusions and recommendations and make any necessary modifications.

We request an opportunity to review the final construction documents and specifications for the proposed facility to verify that the recommendations presented are incorporated into the final design. The recommendations provided in this report are also based on the assumption that the necessary geotechnical observations and testing during construction will be performed by representatives of our firm. The field observation services are considered a continuation of the geotechnical investigation and essential to verify that the actual soil conditions are as anticipated. This also provides for the procedure whereby the Client can be advised of unanticipated or changed conditions that would require modifications of our original recommendations. In addition, the presence of our representatives at the site provides the Client with an independent professional opinion regarding the geotechnical related construction procedures. If another firm is retained for the geotechnical observation services, our professional responsibility and liability would be reduced to the extent that we are no longer the engineer of record.

JOB: 02014015-1 DAE 11/26/14 BY: SCK ENGR REV



SITE PLAN

PROPOSED MID CITY SKATE PARK DE LA CRUZ COMMUNITY PARK SAN DIEGO, CALIFORNIA



(SCALE 1" = 100')

KEY:

- BMC-3** ● Approximate Boring Location and Number
- PMC-1** ▲ Approximate Percolation Test Location and Number

REFERENCE: Google Imagery (2014)

**APPENDIX A
FIELD EXPLORATIONS AND LABORATORY TESTS**

APPENDIX A FIELD EXPLORATIONS AND LABORATORY TESTS

FIELD EXPLORATIONS

The soil conditions were explored by drilling three borings and two percolation test holes at the locations shown on Plate 1. The borings and test holes were drilled to depths of 3 to 14 feet using 8-inch diameter hollow-stem auger drilling equipment. After completion of excavation, the exploratory excavations were backfilled using the excavated soils.

The soils encountered were logged by our field engineer/geologist, who obtained bulk samples for laboratory observation and testing. A California-modified sampler was used to retrieve relatively undisturbed samples. This sampler consisted of a brass-ring-lined split-tube with an inside diameter of 2-1/2 inches and an outside diameter of 3 inches. The hammer used to drive the sampler weighed 140 pounds, and a drop of about 30 inches was used. The number of blows required to drive the sampler 12 inches is indicated on the logs. The logs of the borings are presented on Plates A-1.1 through A-1.3; the depths at which relatively undisturbed samples were obtained are indicated to the left of the logs.

The soils are classified in accordance with the Unified Soil Classification System described on Plate A-2.

LABORATORY TESTS

The field moisture content and dry density of the soils encountered were determined by performing tests on the relatively undisturbed samples. The results of the tests are shown to the left of the boring logs.

Direct shear tests were performed on remolded samples compacted to 90% of the maximum dry density at near optimum moisture content. The tests were performed at various surcharge pressures

after saturation. The yield point values determined from the direct shear tests are presented on Plate A-3, Direct Shear Test Data.

The optimum moisture content and maximum dry density of the soils were determined by performing a compaction test in accordance with ASTM D1557 method. The results of the test are presented on Plate A-4, Compaction Test Data.

To provide information for paving design, a Stabilometer (R-value) test was performed on a sample of the on-site soils. The test was performed in accordance with Standard 301 of the State of California Department of Transportation. The test results are presented on Plate A-5, R-Value Test Data.

The Expansion Index of the on-site soils was determined by testing one sample in accordance with ASTM D4829. The test results are shown on Plate A-6, Expansion Index Test Data.


To determine the particle size distribution of the soils as an aid in classifying the soils, mechanical analyses were performed on two samples in accordance with ASTM Test Method D422. The results of the mechanical analyses are presented on Plates A-7.1 and A-7.2, Particle Size Distribution.

To evaluate the corrosion potential of the on-site soils, one soil sample was tested at an analytical laboratory for pH, resistivity, sulfate and chloride content in accordance with the following standards.

Resistivity and pH – California Test 643
Soluble Chlorides – California Test 417
Soluble Sulfates – California Test 422

The test results are presented on Plate A-8, Corrosivity Test Data.

Note: The log of subsurface conditions shown hereon applies only at the specific boring location and at the date indicated.
It is not warranted to be representative of subsurface conditions at other locations and times.

ELEVATION (ft.)	DEPTH (ft.)	PID READINGS (ppm)	MOISTURE (% of dry wt.)	DRY DENSITY (lbs./cu. ft.)	BLOWS/FOOT	SAMPLE LOC.
	5				64	
	10				100	
	14				100	
	15					
	20					
	25					
	30					
	35					
	40					

BORING BMC-1

DATE DRILLED: 10/28/2014
EQUIPMENT USED: 8-inch Diameter Hollow-stem-auger

LAT 32.7443 LONG -117.1110

FILL - SILTY SAND - fine to medium, medium dense to dense, moist, some gravel and pieces of concrete, brown and light brown
Abundant gravel and cobbles
< SLOW DRILLING >

Very dense

< SLOW DRILLING >

< BORING TERMINATED AT A DEPTH OF 14 FEET DUE TO REFUSAL IN THE GRAVEL AND COBBLES >

NOTES: Groundwater not encountered. Boring backfilled with soil cuttings and bentonite chips.

LOG OF BORING



Note: The log of subsurface conditions shown hereon applies only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

ELEVATION (ft.)	DEPTH (ft.)	PID READINGS (ppm)	MOISTURE (% of dry wt.)	DRY DENSITY (lbs./cu. ft.)	BLOWS/FOOT	SAMPLE LOC.
	5					SM
	10					
	15					
	20					
	25					
	30					
	35					
	40					

BORING BMC-2

DATE DRILLED: 10/28/2014

EQUIPMENT USED: 8-inch Diameter Hollow-stem-auger

LAT 32.7445 LONG -117.1107

FILL - SILTY SAND - fine to medium, medium dense to dense, moist, some gravel and cobbles, light brown

Abundant gravel and cobbles
< SLOW DRILLING >

< BORING TERMINATED AT A DEPTH OF 5 FEET DUE TO REFUSAL IN THE GRAVEL AND COBBLES >

NOTES: Groundwater not encountered. Boring backfilled with soil cuttings and bentonite chips.

LOG OF BORING



Note: The log of subsurface conditions shown hereon applies only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

ELEVATION (ft.)	DEPTH (ft.)	PID READINGS (ppm)	MOISTURE (% of dry wt.)	DRY DENSITY (lbs./cu. ft.)	BLOWS/FOOT	SAMPLE LOC.	
	5		7.9		60 100 38	SM	FILL - SILTY SAND - fine to medium, medium dense, moist, brown to light brown < SLOW DRILLING. ABUNDANT GRAVEL AND COBBLES. BORING MOVED 2 FEET SOUTH > Light brown Medium dense
	10					SM	SILTY SAND - fine to medium, dense to very dense, moist, dark brown and dark grey Brown, abundant gravel and cobbles < BORING TERMINATED AT A DEPTH OF 9-1/2 FEET DUE TO REFUSAL IN THE GRAVEL AND COBBLES >
	15						
	20						
	25						
	30						
	35						
	40						

LOG OF BORING



MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES	
COARSE GRAINED SOILS (More than 50% of material is LARGER than No. 20 sieve size)	GRAVELS (More than 50% of coarse fraction is LARGER than the No. 4 seive size)	CLEAN GRAVELS (Little or no fines)	GW	Well graded gravels or gravel - sand mixtures, little or no fines.	
		GRAVELS WITH FINES (Appreciable amount of fines)	GP	Poorly graded gravels or gravel - sand mixtures, little or no fines.	
			GM	Silty gravels, gravel - sand - silt mixtures.	
			GC	Clayey gravels, gravel - sand - clay mixtures.	
	SANDS (More than 50% of coarse fraction is SMALLER than the No. 4 seive size)	CLEAN SANDS (Little or no fines)	SW	Well graded sands, gravelly sands, little or no fines.	
		SANDS WITH FINES (Appreciable amount of fines)	SP	Poorly graded sands, gravelly sands, little or no fines.	
			SM	Silty sands, sand - silt mixtures.	
			SC	Clayey sands, sand - clay mixtures.	
			SILTS AND CLAYS (Liquid limit LESS than 50)	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
				CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
SILTS AND CLAYS (Liquid limit GREATER than 50)	OL	Organic silts and organic silty clays of low plasticity.			
	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.			
	CH	Inorganic clays of high plasticity, fat clays.			
	OH	Organic clays of medium to high plasticity, organic silts.			
	HIGHLY ORGANIC SOILS	Pt	Peat and other highly organic soils.		







BOUNDARY CLASSIFICATIONS: Soils possessing characteristics of two groups are designated by combinations of group symbols.

PARTICLE SIZE LIMITS

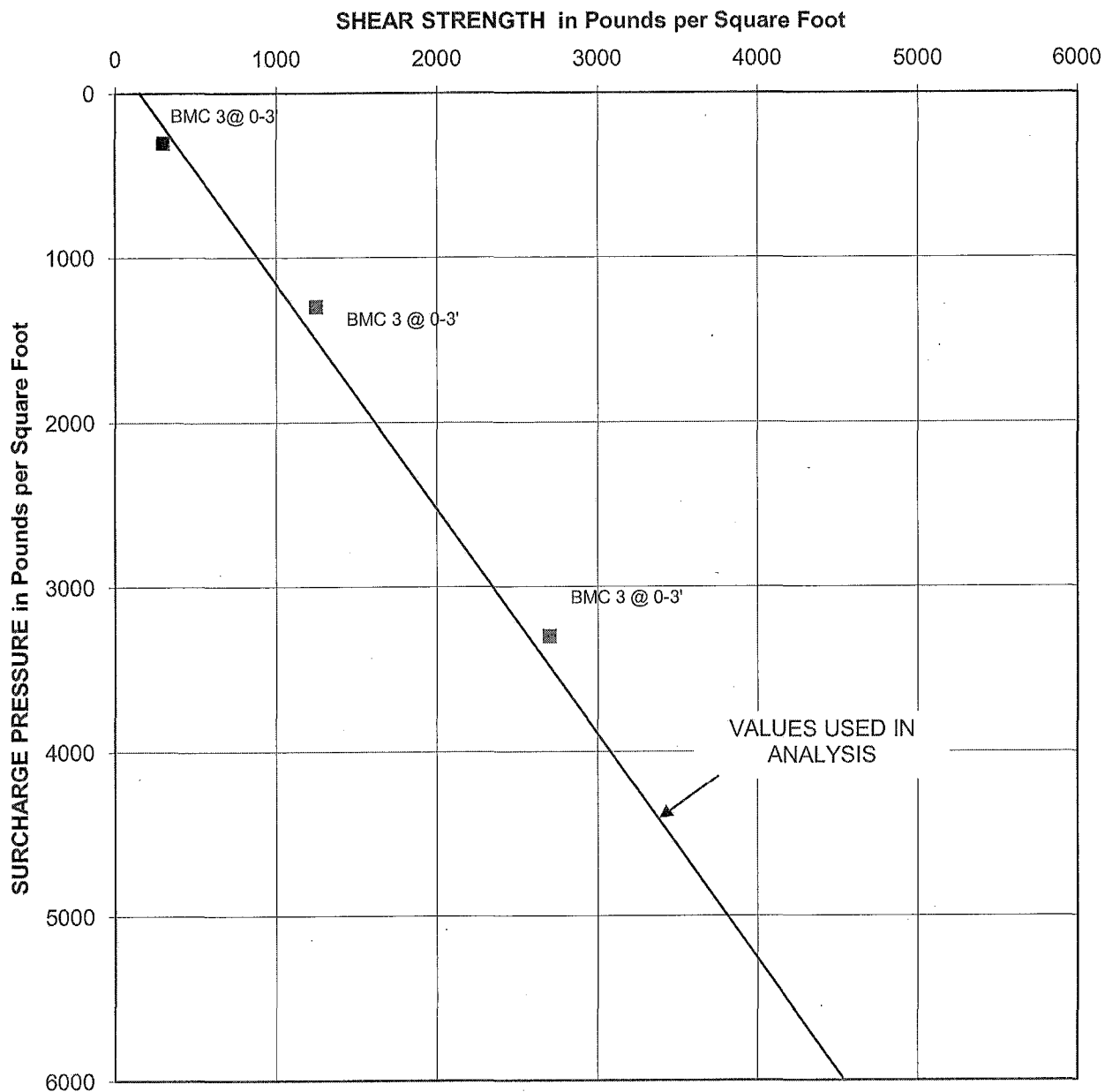
SILT OR CLAY	SAND			GRAVEL		COBBLES	BOULDERS
	Fine	Medium	Coarse	Fine	Coarse		
	No. 200	No. 40	No. 10	No. 4	3/4"	3"	12"

US STANDARD SIEVE SIZE

Key:

-  California Sampler
-  Continuous Auger Coring
-  Standard Penetration
-  HQ Coring
-  No Recovery
-  Bulk or Chunk Sample





KEY:

- Remolded samples (On-site soils: Compacted to 90%)
- All samples tested after saturation

SHEAR SUMMARY



BORING NUMBER AND
SAMPLE DEPTH

BMC 3 @ 0 - 3'

SOIL TYPE

FILL - SILTY SAND
w/Gravel

MAXIMUM DRY DENSITY
(lbs per cubic foot)

127

OPTIMUM MOISTURE
CONTENT
(% of dry weight)

10.5

COMPACTION TEST DATA

(ASTM D1557)

BORING NUMBER AND
SAMPLE DEPTH

BMC 2 @ 0 - 2

SOIL TYPE

FILL - SILTY SAND w/Gravel

R-VALUE

by Exudation	55
by Expansion	---
at Equilibrium	55

R-VALUE TEST DATA

BORING NUMBER AND
SAMPLE DEPTH

BMC 2 @ 0 - 2'

SOIL TYPE

FILL - SILTY SAND
w/Gravel

FINAL MOISTURE
CONTENT

23.3

DRY DENSITY
(in pounds per cubic foot)

110

EXPANSION INDEX

EXPANSION POTENTIAL

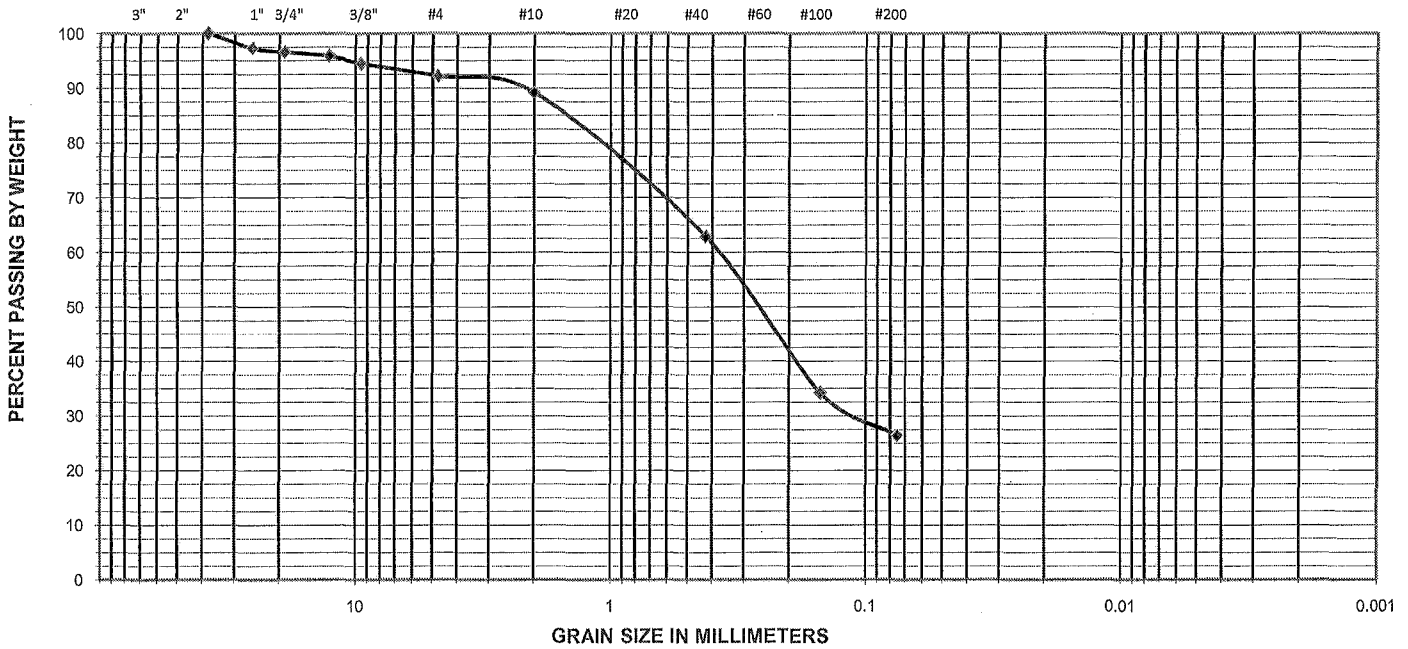
VERY LOW

EXPANSION INDEX TEST DATA
(ASTM D4829)

UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT AND CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	HYDROMETER

US STANDARD SIEVE SIZES



PARTICLE SIZE DISTRIBUTION

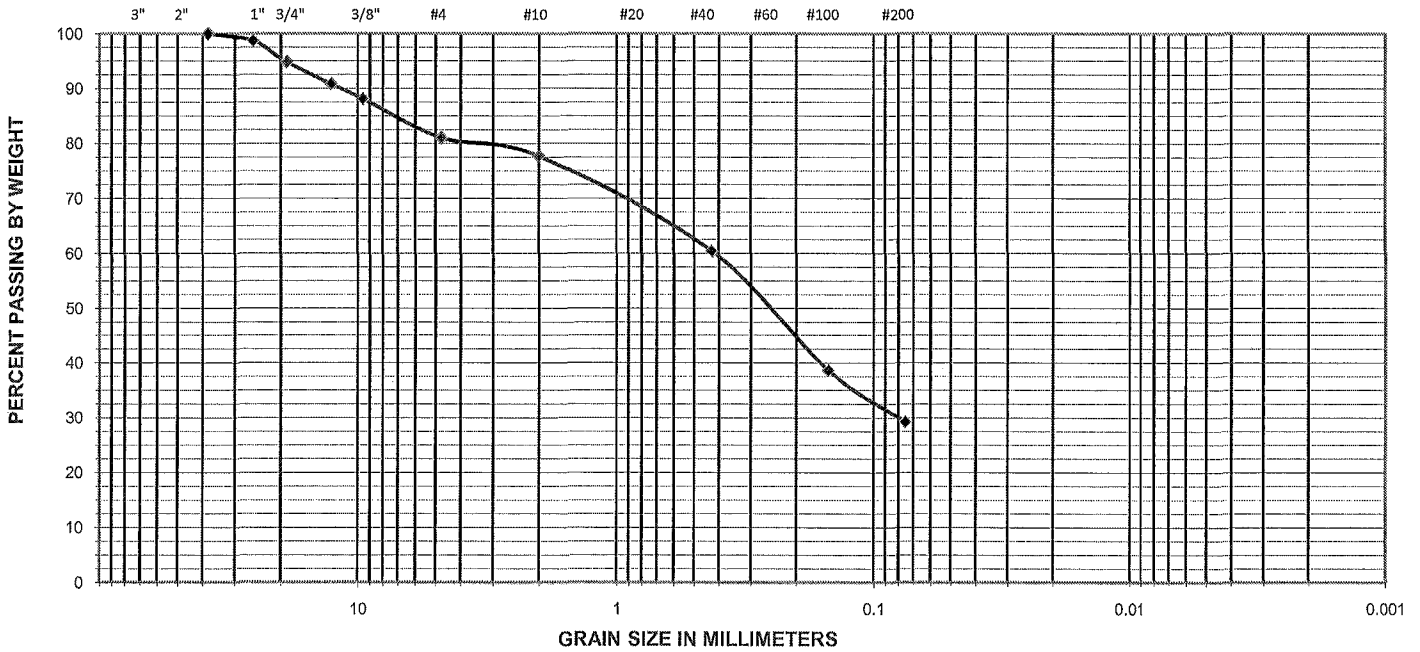
BORING	BMC-2	SOIL TYPE
DEPTH	0 - 2'	SILTY SAND w/Gravel
Job No.	G2014015-1	



UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT AND CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	HYDROMETER

US STANDARD SIEVE SIZES



PARTICLE SIZE DISTRIBUTION

BORING	BMC-3	SOIL TYPE
DEPTH	0 - 3'	SILTY SAND w/Gravel
Job No.	G2014015-1	



BORING NUMBER
AND SAMPLE DEPTH

BMC 1 @ 0 - 2'

Caltrans Method

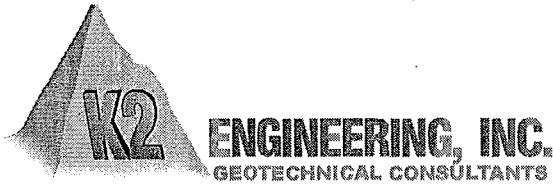
SOIL TYPE

FILL - SILTY SAND
w/Gravel

pH	8.8	643
Resistivity (in ohms-cm)	2,000	643
Soluble Sulfate (%)	0.014	417
Soluble Chloride (%)	0.007	422

CORROSIVITY TEST DATA

APPENDIX B
SUPPLEMENTAL RECOMMENDATIONS -
LIGHT FIXTURE FOUNDATIONS



July 2, 2015

Mr. Jeff Justus
Schmidt Design Group
2655 Fourth Avenue
San Diego, California 92103

Subject: **Supplemental Recommendations
Soils Investigation – Light Fixture Foundations
Proposed Mid City Skate Park
San Diego, California
K2 Engineering Job No. G2014015-1**

Dear Mr. Justus:

As requested, we are pleased to present supplemental recommendations for the proposed Mid City Skate Park in San Diego, California. We previously performed a geotechnical investigation at the site and presented the results in a report dated December 10, 2014.

The purpose of this letter is to provide supplemental recommendations for the foundation design of the proposed light fixtures. *The conclusions and recommendations presented in the report are valid unless specifically modified in this letter. The December 10, 2014 report should be consulted for a complete description of the subsurface conditions encountered.*

The information in this letter represents professional opinions that have been developed using that degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical consultants practicing in this or similar localities. *No other warranty, express or implied, is made as to the professional advice included in this letter.*

12595 RAGWEED STREET, SAN DIEGO, CALIFORNIA 92129 • PHONE (858)484-2347 • FAX (858)484-8682

CONCLUSIONS AND RECOMMENDATIONS

Subsurface Conditions

Fill soils extending to the maximum depth explored of 14 feet were encountered in the exploratory excavations. The fill soils consisted of medium dense to dense, moist, silty sand with abundant gravel and cobbles. Pieces of concrete were encountered in one of the borings. Refusal in a gravel and cobble layers was encountered at depths of 4 to 14 feet in the exploratory borings.

The fill soils were reportedly placed during rough grading of the area. The composition of the fill, including the amount and/or size of debris, fills depth or the degree of compaction are not known. Groundwater was not encountered within the exploratory excavations.

Light Pole Foundations

Due to the potential variations of the in-place fills, we are providing foundation design parameters for those conditions. Special excavation techniques may be required if abundant debris and/or oversized rocks are encountered in the pier excavations.

Individual piers should be adequate to support the lighting pole foundations. Embedment depth and diameter for the lighting pole piers to resist lateral loads where no-constraint is provided at ground surface may be determined using the following formula per 2013 CBC Section 1807.3.2.1:

$$d = A/2 \{1 + [1+(4.36h/A)]^{1/2}\}$$

Where:

$$A = 2.34P/S_1b$$

b = Pier diameter in feet

d = Embedment depth in feet (but not over 12 ft for purpose of computing lateral pressure)

h = Distance in feet from ground surface to point of application of "P"

P = Applied lateral force in pounds

S_1 = Allowable lateral soil bearing pressure $S_1 = 150$ psf/ft. (Table 1806.2 for Class 4 soil and Section 1806)

An allowable soil vertical bearing pressure of 1,000 pounds per square foot may be used in the design of the piers at least 2 feet in diameter and extending at least 3 feet below the lowest adjacent grade. The values provided are for the medium dense to dense fill soils. Excavations may need to be deepened to obtain the desired resistance and/or to avoid obstructions.

Installation: The drilled pier shall be placed in conformance to ACI 336 guidelines. Excavation for piers should be inspected by the geotechnical consultant. The bottom of the excavation for piers should be reasonably free of loose or slough material. A tremie pipe should be used to pour concrete from the bottom up and to ensure less than five feet of free fall.

- o0o -

We trust this letter provides you with the information you require at this time. Should you have any questions regarding the information presented, please do not hesitate to call.

Sincerely,

K2 ENGINEERING, INC.



Susana Kemmerrer, RGE 2287
President



Submitted via e-mail JJustus@SchmidtDesign.com

reports/Schmidt Design/G2014015-1 Mid City Supplemental Pole Foundations 7-2-15.doc

APPENDIX G

WATER QUALITY TECHNICAL REPORT, REVISED FEBRUARY 29, 2016

WATER QUALITY TECHNICAL REPORT

For Park De La Cruz Improvements City of San Diego Dwg. 38888

July 6, 2015

Revised: January 25, 2016

Revised: February 29, 2016

JN 141021

Prepared For:
SCHMIDT DESIGN GROUP
1111 6th Ave. Ste. 500
San Diego, CA 92101

Prepared By:
O'DAY CONSULTANTS
2710 Loker Avenue West, Suite 100
Carlsbad, CA 92010



Nichole Fine

Nichole Fine

C 70035

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Appendices

Appendix A- 50 Year Hydrologic Calculations for Existing Conditions

Appendix B- 50 Year Hydrologic Calculations for Proposed Conditions

Appendix C- Water Quality Calculations

Appendix D- Hydromodification (Water Volume) Calculations Utilizing the SWMM Model- Drawdown Calculations

Appendix E- Soils Investigation for Mid City Skate Park, Prepared by K2 Engineering

Appendix F- Hydraulic Calculations for Storm Drains and Structures

Appendix G- Detention Calculations & Hydrology for Skate Park

Exhibits

Exhibit A	-	Vicinity Map
Exhibit B	-	Storm Water Requirements Applicability Checklist
Exhibit C	-	Water Quality Sensitive Areas Map
Exhibit D	-	Figure 4-1 HMP Applicability Determination
Exhibit E	-	Table 4-1: Anticipated and Potential Pollutants
Exhibit F	-	San Diego Region Hydrologic Boundary Map
Exhibit G	-	2010- 303(d) List for Impaired Water Bodies
Exhibit H	-	Table 2-2 Beneficial Uses of Inland Waters
Exhibit I	-	Table 4-3 Structural BMP Treatment Control Selection Matrix
Exhibit J	-	Project Site Plan and BMP Map
Exhibit K	-	Fact Sheets from CASQA & BMP Design Manual
Exhibit L	-	Run-off Coefficients (Table 2) & Supplemental Calculations
Exhibit M	-	Intensity-Duration Chart
Exhibit N	-	Urban Area Overland Time of Flow Curves
Exhibit O	-	Rainfall Gage Map
Exhibit P	-	WebSoil Survey Hydrologic Soil Group Map
Exhibit Q	-	85 th Percentile Isopluvial Map
Exhibit R	-	Monthly Evapotranspiration Rates and Map
Exhibit S	-	Continuous Simulation Subcatchment Parameters (Excerpts from Appendix G of Model BMP Design Manual)
Exhibit T	-	Continuous Simulation Bioretention Cell Parameters (Excerpts from Appendix G of Model BMP Design Manual)
Exhibit U	-	Pre-Developed Conditions Maps
Exhibit V	-	40 Scale Drainage Map for Existing Conditions
Exhibit W	-	40 Scale Drainage Map for Proposed Conditions
Exhibit X	-	50 Year, 6 hour Isopluvial Chart
Exhibit Y	-	Runoff Factors for DCV Calculations (Excerpts from Appendix B of Model BMP Design Manual)
Exhibit Z	-	Hydraulic Map
Exhibit AA	-	City of San Diego Form DS-563

1.0 INTRODUCTION

This Water Quality Technical Report was prepared to support the Improvement Plans for Park De La Cruz, City of San Diego DWG. 38888 and to identify and summarize the permanent storm water Best Management Practices (BMPs) incorporated into the site. The purpose of the BMPs is to mitigate the impacts of urban runoff stemming from the proposed development.

At the time of preparation of this study, the storm water quality requirements are based on the California Regional Water Quality Control Board for San Diego (SDRWQCB) R9 2007-001 MS4 permit and the City of San Diego Storm Water Standards Manual, 2012.

However, in May 2013 the SDRWQCB issued a new MS4 permit (R9 2013-001, later revised by R9 2015-001). Because of the schedule of the project this new permit will affect the project prior to commencing construction. Some of the critical items from the new order affecting our project are as follows:

1. If rain harvesting and retention are not feasible on the project site, then the BMPs shall be designed to treat 1.5 times the Design Capture Volume (DCV) or treat the design capture volume not reliably retained onsite with a flow thru design that has a total volume, including pore spaces and pre-filter detention volume, sized to hold at least 0.75 times the portion of the volume not reliably retained onsite. This design capture volume is based on the 24-hour, 85th percentile storm event.
2. The flow control, hydromodification management, requirements are based on controlling flow to the pre-developed condition, rather than the current existing conditions approach.

The Model BMP Design Manual for the San Diego Region was prepared in June 2015 to replace the current Countywide Model Standard Urban Stormwater Mitigation Plan (SUSMP), dated March 25, 2011. This manual was used in conjunction with the City of San Diego Storm Water Standards Manual to insure that our project meets the requirements of the current standards and the new permit.

1.1 Project Description

The project site is located in San Diego, California within the City Heights Community. The project site is bounded on the north by Landis Street, on the east by the Interstate 15 Freeway, on the west by 38th Street and on the south by Dwight Street. See Exhibit A for a Vicinity Map.

The park improvements consist of the addition of a skate park along the southeasterly portion of the site, upgrading existing site features for ADA compliance, and improvements at the west side of the existing YMCA parking lot to unite the Cherokee Point Park and ball fields to the north.

The site was constructed with the improvements of the I15 Freeway, Park De La Cruz was constructed by Caltrans contract no. 11-0486E4. The existing parking lot at the northwest corner of the site and infrastructure was built per Caltrans contract no. 11-048661.

Pre-Developed Conditions

According to the Aerial Topographic Map and orthophoto image dated 10-26-1978 for the City of San Diego and the USGS map from 1967 (See Exhibit U), it appears that there was an existing natural channel cut diagonally from the north west to the southeast through our project site in the pre-developed conditions. Pre-developed slopes range between 20% to at least 2:1.

Existing Conditions

There are two distinct drainage areas at the site. The southerly drainage basin, includes the existing ball field that drains at less than 2% towards a storm drain along the southeast perimeter of the site. This existing 24" storm drain, through a series of catch basins, conveys storm water towards the south. The northerly drainage basin includes, the parking lot at the northwest corner of the site along with the adjacent landscape area drains towards an existing 18" storm drain. This storm drain conveys storm water to the storm drain system in Landis Street. See Exhibit V for the existing conditions drainage map and Appendix A for the existing hydrologic calculations.

Proposed Conditions

The proposed conditions consist of construction of a skate park along the southeasterly portion of the site, upgrading existing site features for ADA compliance, and improvements at the west side of the existing YMCA parking lot to unite the Cherokee Point Park and ball fields to the north.

The skate park will drain towards a biofiltration facility at the southwest corner of the site, the storm water will be treated and detained prior to draining through the existing 18" storm drain to the south. In addition, several biofiltration facilities will be constructed along the walkway adjacent the ball field to treat storm water from the walkway along the ballfield that is being replaced.

A portion of the parking lot and ADA facilities west of the community center will drain towards two biofiltration facilities that will treat and detain the storm water prior to draining to the stormdrain system to the north. See Exhibit W for the proposed conditions drainage map and Appendix B for the proposed hydrologic calculations.

Hydrologic Calculations

Hydrologic calculations were performed utilizing the City of San Diego Drainage Design Manual, April 1984. Pertinent exhibits from the City of San Diego Drainage Design Manual are enclosed for reference, as follows:

- Exhibit L - Run-off Coefficients (Table 2)- & Additional Calculations
- Exhibit M - Intensity-Duration Chart
- Exhibit N - Urban Area Overland Time of Flow Curves
- Exhibit V - 40 Scale Hydrologic Map for Existing Conditions
- Exhibit W - 40 Scale Hydrologic Map for Proposed Conditions

Based on the City of San Diego Drainage Design Manual if tributary areas are less than 1 square mile, the runoff criteria for the underground storm drain system shall be based upon a 50 year frequency storm. In addition, if the project area is under 0.50 square miles the rational method can be used to analyze hydrology. The total drainage area is 6.87 acres, less than 0.50 square miles.

Summary for Park De La Cruz 50 Year Flowrate			
Basin	Drainage Area	Existing 50 Year Flowrate	Proposed 50 Year Flowrate
Basin A/C	5.51 AC	11.38 CFS	10.72 CFS *
Basin B/D	1.36 AC	3.38 CFS	3.19 CFS

See Appendix A and B for Existing and Proposed 50 Year Hydrologic Calculations.

*The decrease in flowrate for Basin A/C is attributed to the detention in the skate park and the capacity of the pump at the southwest corner of the site. See Appendix G for skatepark hydrology and detention calculations.

A 100 Year Frequency storm was analyzed for sizing catch basins, see Appendix B, page 34 for catch basin sizing.

Water Quality and Hydromodification

Sizing for water quality will be based on the Design Capture Volume (DCV) based on the new order. See Appendix C for calculations.

Continuous simulation modeling software, Storm Water Management Model (SWMM), developed by the USEPA, will be utilized to size the BMP facilities for flow control to meet the thresholds based on the pre-developed condition. The hydromodification calculations are depicted in Appendix D.

1.2. Applicable Storm Water Standards

1.2.1 Storm Water Requirements Applicability Checklist

Although a portion of the site (N.W. Corner) actually decreases the amount of impervious surface from existing to proposed condition, the addition of the skate ramp increases the amount of impervious surface more than 5000 sf. Per the Storm Water Requirements Applicability Checklist (Form DS-560), see Exhibit B, this project meets PRIORITY DEVELOPMENT PROJECT (PDP) requirements and must comply with additional storm water criteria per the City of San Diego Storm Water Standards Manual dated January 20, 2012 and the requirements of the new MS4 permit R9 2013-001.

It should be noted that water quality requirements do not apply to the following activities:

1. Resurfacing existing roads and parking lots, including slurry, overlay and restriping
2. Routine replacement of damaged pavement, including full depth replacement, if the sole purpose is to repair the damage
3. Constructing new sidewalk, pedestrian ramps or bike lanes on existing roads (within the existing street right-of-way).

1.2.2 HMP Applicability Determination

Per Figure 4-1 of the City of San Diego HMP Applicability Determination, Hydromodification controls are required. (See Exhibit D.) It was determined that field investigations would not be conducted pursuant to the SCCWRP channel screening tools. Therefore the site must mitigate peak flows and durations based on a pre-project condition lower flow threshold of 0.1Q2.

1.2.3 Redevelopment Projects (50% Rule)

Existing Impervious Surface: Basin A and Basin B	102,090 SF (See Exhibit V)
Impervious Surface to be removed/replaced & New	39,850 SF (See Exhibit J)

$$\frac{39,850 \text{ sf}}{102,090 \text{ sf}} = 39.0\%$$

Which is less than 50%, therefore under the new order R9-2013-0001, Section E.3.b, the structural BMP performance requirements and hydromodification management requirements apply only to the creation or replacement of impervious surface and not to the entire development.

2. POLLUTANTS AND CONDITIONS OF CONCERN

2.1 Identify Pollutants Associated with Type of Project Use

Per Table 4-1 of the City of San Diego Storm Water Manual (see Exhibit E), the pollutants anticipated for : commercial development > 1 acre

1. Potential for sediment
2. Potential for nutrients
3. Heavy metals
4. Potential for Organic Compounds
5. Trash and debris
6. Potential for oxygen demanding substances
7. Oil and grease
8. Potential for Bacteria and Viruses
9. Potential for pesticides from landscaping

2.2 Identify Watershed, Hydrologic Unit Basin and Receiving Waters

The project is located in the Hydrologic Unit 908.22 of the Pueblo San Diego Watershed in the San Diego Mesa Hydrologic Area, Chollas Hydrologic Sub-Area. Stormwater on site drains into Chollas Creek and eventually outlets San Diego Bay. See Exhibit F.

2.3 List of Impaired Water Bodies

According to the California 2010 303(d) list of Water Quality limited Segments published by the RWQCB, there are currently TMDLs established for the Chollas Creek. Please refer to Exhibit G.

The impairments for this water body are listed below:

- *Chollas Creek:*

<u>Pollutants</u>	<u>Pollutant Category</u>
Copper	Metal
Diazinon	Pesticide
Indicator Bacteria	Pesticide
Lead	Metal
Phosphorous	Nutrient
Total Nitrogen	Nutrient
Trash	Trash
Zinc	Metal

2.4 Summary of Primary Pollutants

Based on the anticipated project pollutants and the impairment of the receiving waters, the primary pollutants of concern for this project are metals, pesticides, nutrients and trash. The selection of treatment control BMPs in Section 3 is based on this information.

3.0 SELECTION OF BEST MANAGEMENT PRACTICES (BMPS)

3.1 Source Controls BMPs

- Maintenance bays;
- Vehicle and equipment wash area;
- Outdoor processing area;
- Retail and non-retail fueling areas;
- Steep hillside landscaping*;
- Use efficient irrigation systems and landscape design*;
- Design trash storage areas to reduce pollution contribution*;
- Design outdoor material storage areas to reduce pollution contribution;
- Design loading docks to reduce pollution contribution;
- Employ integrated pest management principles*;
- Provide storm water conveyance system stampage and signage*;
- Manage fire sprinkler discharges;
- Manage air conditioning condensate;
- Use non-toxic roofing materials where feasible*; and,
- Other source control requirements*.

* Denotes BMPs applicable to this project.

These are discussed in detail below. Note that the italicized descriptions of each BMP were taken from the Storm Water Standards Manual. Immediately following is a narrative of the project's plan for implementation.

3.1.1 Maintenance bays

Maintenance bays shall include at least one of the following:

- *Repair/ maintenance bays shall be indoors; or,*
- *Drainage system designed to preclude urban run-on and runoff.*

Maintenance bays shall include a repair/maintenance bay drainage system to capture all wash water, leaks, and spills. Drains shall be connected to a sump for collection and disposal. Direct connection of the repair/maintenance bays to the storm water conveyance system is prohibited.

Project site does not propose maintenance bays; therefore, this source control is not applicable.

3.1.2 Vehicle and equipment wash area

Areas for washing/steam cleaning of vehicles and areas for outdoor equipment/accessory washing and steam cleaning shall be:

- *Self-contained to preclude run-on and run-off, covered with a roof or overhang, and equipped with a clarifier or other pretreatment facility; and*
- *Properly connected to a sanitary sewer.*

Project site does not propose vehicle/equipment wash area; therefore, this source control is not applicable.

3.1.3 Outdoor processing area

Outdoor processing areas shall:

- *Cover or enclose areas that would be the most significant source of pollutants;*
- *Slope the area toward a dead-end sump; or*
- *Discharge to the sanitary sewer system.*

Berms or site grading shall be utilized to prevent run-on from surrounding areas. Installation of storm drains in areas of equipment repair is prohibited.

Project site does not propose outdoor processing area; therefore, this source control is not applicable.

3.1.4 Retail and non-retail fueling areas

Retail and non-retail fueling areas shall be:

- *Paved with Portland cement concrete or equivalent smooth impervious surface (asphalt concrete is prohibited);*
- *Designed to extend 6.5 feet (2.0 meters) from the corner of each fuel dispenser, or the length at which the hose and nozzle assembly may be operated plus 1 foot (0.3 meter), whichever is less;*
- *Sloped to prevent ponding;*
- *Separated from the rest of the site by a grade break that prevents run-on of adjacent urban runoff; and*
- *Designed to drain to the project's treatment control BMP(s) prior to discharging to the storm water conveyance system.*

The overhanging roof structure or canopy shall be:

- *Equal to or greater than the area within the fuel dispensing area's grade break; and*
- *Designed to drain away from the fuel dispensing area.*

Project site does not propose retail and/or non-retail fueling area; therefore, this source control is not applicable.

3.1.5 Steep hillside landscaping

Steep hillside areas disturbed by project development shall be landscaped with deep-rooted, drought tolerant and/or native plant species selected for erosion control, in accordance with the Landscape Technical Manual.

For the existing steep slope along the southeast perimeter of the site that will be disturbed by construction, these hills will be landscaped with deep-rooted, drought tolerant and/or native plant species. Landscape plans shall be prepared in accordance with the Landscape Technical Manual and submitted to the City of San Diego for review and approval.

3.1.6 Use efficient irrigation systems and landscape design

- *Implement rain shutoff devices to prevent irrigation during and after precipitation events in accordance with section 2.3-4 of the City of San Diego's Landscape Standards.*
- *Reduce irrigation contribution to dry-weather runoff by avoiding spray irrigation patterns where overspray to paved surfaces or drain inlets will occur.*
- *To avoid overwatering and potential irrigation runoff, design irrigation systems to each landscape area's specific water requirement.*
- *Implement flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines.*
- *Avoid locating drain inlets in lawn areas, since such inlets tend to be sources of irrigation runoff and the transport mechanism for lawn care products. Design the grading and drainage systems such that drain inlets can be located outside of the lawn area, or include a non-turf buffer around the inlet.*

Landscape and grading plans shall be prepared using the guidelines above to the extent feasible. Plans shall be submitted to the City of San Diego for review and approval.

3.1.7 Design trash storage areas to reduce pollution contribution

Trash storage areas shall:

- *Be paved with an impervious surface designed to prevent run-on from adjoining areas and screened or walled to prevent off-site transport of trash.*
- *Contain attached lids on all trash containers to prevent rainfall intrusion.*
- *Contain a roof or awning, at the discretion of the City, for high usage trash areas such as those for fast food establishments, convenience stores, and high-density residential developments.*

Trash storage area is located within the parking lot and enclosed with a wall and trellis structure. Per design, no rainfall intrusion will occur and no runoff will result from the area. In addition to the large refuse facility several smaller trash cans will be located through the park site to prevent the accumulation of litter.

3.1.8 Design outdoor material storage areas to reduce pollution contribution

Materials with the potential to contaminate urban runoff shall be:

- *Placed in an enclosure such as a cabinet, shed, or other structure that prevents contact with rainfall or runoff and prevents spillage to the storm water conveyance system, and*
- *Protected by secondary containment structures such as berms, dikes, or curbs when the material storage area includes hazardous materials. The storage area shall be paved and sufficiently impervious to contain leaks and spills and be covered by a roof or awning to minimize direct precipitation within the secondary containment area.*

Project site does not propose outdoor material storage area; therefore, this source control is not applicable.

3.1.9 Design loading docks to reduce pollution contribution

Loading docks areas shall:

- *Provide overhead cover where appropriate to prevent precipitation contact with debris and potential spills, and*
- *Isolate drainage in the loading dock area through the use of paved berms and/or grade breaks to prevent adjacent runoff from entering the loading area and to prevent liquid spills from discharging from the loading area.*
- *Include an acceptable method of spill containment such as a shut-off valve and containment areas.*

Project site does not propose loading docks; therefore, this source control is not applicable.

3.1.10 Employ integrated pest management principles

Integrated pest management (IPM) is an ecosystem-based pollution prevention strategy that focuses on long-term prevention of pests or their damage through a combination of techniques such as:

- *Biological control*
- *Habitat manipulation*
- *Use of resistant plant varieties.*

Pesticides are used only after monitoring indicates they are needed according to established guidelines. Pest control materials are selected and applied in a manner that minimizes risks to human health, beneficial and non-target organisms, and the surrounding environment. More information regarding pesticide application may be obtained at the following University of California-Davis website: <http://www.ipm.ucdavis.edu/WATER/U/index.html>.

To eliminate or reduce the need for pesticide use, the following strategies can be used:

- *Plant pest-resistant or well-adapted plant varieties*
- *Discourage pests by modifying the site and landscaping design.*

IPM educational materials should be distributed to future site residents and tenants. These educational materials should address the following:

- *Use of barriers, screens, and caulking to keep pests out of buildings and landscaping*
- *Physical pest elimination techniques, such as weeding, washing, or trapping pests*
- *Relying on natural enemies to eliminate pest*
- *Proper use of pesticides as a last line of defense.*

Landscape and improvement plans shall be prepared using the guidelines above to the extent feasible. Plans shall be submitted to the City of San Diego for review and approval.

Also, IPM educational materials addressing the issues described above shall be prepared and distributed to the community.

3.1.11 Provide storm water conveyance system stampage and signage

- *Concrete stamping, or approved equivalent method, shall be provided for all storm water conveyance system inlets and catch basins within the project area.*
- *Language associated with the stamping (e.g., “No Dumping – I Live in Chollas Creek”) must be satisfactory to the City Engineer. Stamping may also be required in Spanish.*

Grading plans shall include specifications for stampage and signage of the storm drain system. Plans shall be submitted to the City of San Diego for review and approval.

3.1.12 Manage fire sprinkler discharges

For new buildings with fire sprinkler systems, design fire sprinkler systems as follows:

- *Contain discharges from sprinkler systems' operational maintenance and testing and convey discharges to the sanitary sewer system.*

Project site does not propose outdoor material storage area; therefore, this source control is not applicable.

3.1.13 Manage air conditioning condensate

Air conditioning condensate is a source of dry-weather runoff and elevated copper levels. Include design features to manage this pollutant source, including the following:

- *Direct air conditioning condensate to the sanitary sewer system*
- *Direct air conditioning condensate to landscaping areas.*

Project site does not propose air conditioners; therefore, this source control is not applicable.

3.1.14 Use non-toxic roofing materials where feasible

- *Avoid the use of galvanized steel or copper for roofs, gutters, and downspouts*
- *If using such materials, reduce the potential for leaching of metals by applying a coating or patina*
- *Avoid composite roofing materials that contain copper.*

Building materials for the shade structures along the picnic facilities to the north shall include specifications to comply with above. Plans shall be submitted to the City of San Diego for review and approval.

3.1.15 Other source control requirements:

- *Require implementation of post-construction soil stabilization practices, such as the re-vegetation of construction sites, in conformance with the approved Landscaping Plan and Grading Plans.*
- *Restrict the use of galvanized and copper roofing materials.*

Pet waste collection dispensers will be utilized on site to prevent pollution from pet waste.

3.2. LOW IMPACT DEVELOPMENT (LID) DESIGN PRACTICES

3.2.1 Optimization of site layout

- 1) Topography is utilized in the site design, the proposed skate park is located upstream of the proposed Biofiltration Facility.
- 2) The drainage pattern from existing to proposed condition shall remain the same.
- 3) Conserve Natural Areas- Since the site is a park site, there are large amounts of pervious surfaces, including the baseball field that will remain from existing to proposed condition.

3.2.2 Minimize Impervious Footprint/ Implement Pervious Surfaces

- 1) The amount of impervious surface within Drainage Basin B (NW Corner) has been reduced from 37,340 sf to 32,890 sf in the proposed condition. A reduction of 4,450 sf of pavement.
- 2) Reinforced turf and paver block will be utilized on the east side of the community center building to increase the width for emergency vehicle access and provide an ADA compliant walkway.

3.2.3. Disperse Runoff to Adjacent Landscaping and IMPs

- 1) The proposed impervious concrete picnic area at the northwest corner of the site will drain towards that landscape turf and through a swale before outletting into the IMP.
- 2) The self treating landscape areas will drain directly into the storm drain systems so that there will be no run-on over impervious surfaces.

3.2.4. Provide Energy Dissipation

- 1) Rip-Rap shall be placed at all proposed storm drain outfalls within the biofiltration facilities.

3.3 STRUCTURAL TREATMENT CONTROL BMPs/INTEGRATED MANAGEMENT PRACTICES (IMPs)

3.3.1 Selection process for IMP's

According to Table 4-3, in Exhibit I, Infiltration Facilities provide the highest effectiveness for removal of pollutants in all categories. Since the IMP facilities will be adjacent an existing steep slope and streets/walkways, we are proposing lined bioretention facilities. The Bioretention Basin has a high removal efficiency to remove all the pollutants of concern.

Bioretention facilities detain stormwater and filter it slowly through soil or sand and are versatile in that they can be any shape and can be landscaped. The bioretention areas onsite were sized to treat stormwater. 3 of the bioretention facilities (BMP No. 1, 5, and 6 on Exhibit J) are designed to limit flow control for hydromodification. In addition, these three facilities will have a 30" thick media layer to treat for nutrients such as phosphorous and nitrogen.

3.3.2 Geotechnical recommendation on soil infiltration rates

According to the percolation tests results in the Soils Investigation for the Proposed Mid City Skate Park by K2 Engineering, Inc on December 10, 2013; the soils percolate between moderately slow (0.69 in/hr) to very slow (0 in/hr), see Appendix E. However, because the bioretention facilities are adjacent to walkways, the skate park, and an existing slope (south side of site) an impermeable liner and 8" perforated drain will be used. See Exhibit J for BMP exhibit and bioretention section.

3.3.3 Numeric Sizing Requirements for Treatment Control BMPs

Based on Section E.3.c of the MS4 Permit (R9-2013-001) LID BMPs shall retain onsite the pollutants contained in the volume of storm water runoff produced from a 24-hour 85th percentile storm. If retention of the full design capture volume is not feasible, then biofiltration BMPs may be utilized to maximize pollutant removal. The biofiltration facilities must be sized to:

- A. Treat 1.5 times the design capture volume not reliably retained or
- B. Treat the design capture volume not reliably retained onsite with a flow thru design that has a total volume, including pore spaces and pre-filter detention volume, sized to hold at least 0.75 times the portion of the volume not reliable retained onsite.

Since none of the storm water on site will be detained, 1.5 times the DCV is smaller than 1.75 times the DCV, hence 1.5 times the DCV will be utilized in the water quality calculations.

This design capture volume is based on the 24-hour, 85th percentile storm event. See Appendix C for Water Quality Calculations.

3.3.4 Hydromodification Management Requirements

Based on the current City of San Diego Storm Water Standards Manual *flow controls for redevelopment project are only required where the redevelopment project increases impervious area or peak flow rates as compared to the pre-project condition (Section 4.5.1)*. The hydromodification requirement does not apply to the northerly basin because we are decreasing impervious areas and peak flows. However, in order to comply with the new MS4 permit we analyzed both basins for hydromodification to the pre-developed condition.

The run-off rates and durations shall be controlled to maintain or reduce pre-developed downstream erosion conditions and protect stream habitat, see Appendix D for hydromodification calculations.

Flow Control Performance Criteria:

1. For flow rates ranging from 10 percent of the pre-project 2-year run-off event to the pre-project 10 year run-off event, the post project discharge rates and durations shall not deviate above the pre-project rates and durations by more than 10 percent over and more than 10 percent of the length of the flow duration curve.
2. For flow rates ranging from the lower flow threshold to the 5-year runoff event, the post-project peak flows shall not exceed pre-project peak flows. For flow rates from Q5 to Q10, post roject peak flows may exceed pre-project flows by up to 10 percent for a 1-year frequency interval.

Field investigations were not conducted pursuant to SCCWRP screening tools. Therefore, the site must mitigate peak flows and durations based on a pre-project condition lower flow threshold of 0.1Q2.

Continuous Simulation Modeling:

Appendix G of the Model BMP Design Manual provides guidance for Continuous Simulation and Hydromodification Sizing Factors. This Appendix together with the Storm Water Management Model SWMM (developed by the USEPA) is utilized to provide hydrologic modeling to demonstrate compliance with the performance standards for hydromodification management in San Diego. See Appendix D for Calculations.

4. OPERATION AND MAINTENANCE

4.1 Ownership and responsibility of maintenance of BMP's

Since the project site is public park, the responsibility of maintenance for the BMP facilities will be provided by the City of San Diego, Parks and Recreation Department.

202 C Street, MS 35
San Diego, CA 92101-3860

4.2 Summary of maintenance requirements

Biofiltration facilities remove pollutants primarily by filtering runoff slowly through aerobic, biologically active soil. Routine maintenance is needed to ensure that flow is unobstructed, that erosion is prevented, and that soils are held together by plant roots and are biologically active. Typical maintenance consists of the following:

- Inspect **inlets** for channels, exposure of soils, or other evidence of erosion. Clear any obstructions and remove any accumulation of sediment. Examine rock or other material used as a splash pad and replenish if necessary.
- Inspect **outlets** for erosion or plugging.
- Inspect **side slopes** for evidence of instability or erosion and correct as necessary.
- Observe the surface of bioretention facility soil for uniform **percolation** throughout. If portions of the bioretention facility do not drain within 24 hours after the end of a storm, the soil should be tilled and replanted. Remove any debris or accumulations of sediment.
- Confirm that **check dams** and **flow spreaders** are in place and level and that rivulets and channelization are effectively prevented.
- Examine the **vegetation** to ensure that it is healthy and dense enough to provide filtering and to protect soils from erosion. Replenish mulch as necessary, remove fallen leaves and debris, prune large shrubs or trees, and mow turf areas. When mowing, remove no more than 1/3 height of grasses. Confirm that irrigation is adequate and not excessive and that sprays do not directly enter overflow grates. Replace dead plants and remove noxious and invasive vegetation.
- Abate any potential **vectors** by filling holes in the ground in and around the bioretention facility and by insuring that there are no areas where water stands longer than 48 hours following a storm. If mosquito larvae are present and persistent, contact the San Diego County Vector Control Program for information and advice. Mosquito larvicides should be applied only when absolutely necessary and then only by a licensed individual or contractor.

5. WQTR Certification Statement

The selection, sizing, and final design of storm water treatment and other control measures in this plan meet the requirements of Regional Quality Control Board Order R9-2013-0001 and subsequent amendments.

Nichole Fine

Nichole A. Fine
RCE 70035

3/3/2016

Date

Appendix A

50 Year Existing Hydrologic Calculations

Summary of Existing 50 Year Hydrologic Calculations for Mid City Skate Park

Basin A

Description Process	NODE	ELEV	NODE	ELEV	Length	SLOPE ¹	Time ³ (min)	I ⁴ (in/hr)	AREA (AC)	C	AC	Q ⁵ cfs	Velocity (fps) ²	SD Size
Initial Area BASIN A1	100	335.2	101	324.3	270	4.0%	6.5 ⁶	3.9	1.08	0.82	0.9	3.45		
Travel Time	101	321.1	102	318.9	100	2.2%	0.2						8.12	12"
BASIN A2					Total Time =		6.7	3.85	0.28	0.56	0.2	4.01		
Travel Time	102	318.9	103	315.3	345	1.0%	0.7						7.98	24"
BASIN A3					Total Time =		7.4	3.7	3.19	0.5	1.6	9.76		
Travel Time	103	315.3	104	286	235	12.5%	0.1						31.6	24"
BASIN A4					Total Time =		7.5	3.65	0.96	0.5	0.5	11.38		

Basin B

Description Process	NODE	ELEV	NODE	ELEV	Length	SLOPE ¹	Time ³ (min)	I ⁴ (in/hr)	AREA (AC)	C	AC	Q ⁵ cfs	Velocity (fps) ²	SD Size
Initial Area BASIN B1	200	331.7	201	325.5	190	3.3%	7.8 ⁶	3.5	0.78	0.73	0.6	1.99		
Travel Time	201	322.7	202	321.2	208	0.7%	0.9						3.94	18"
BASIN B2					Total Time =		8.7	3.4	0.58	0.73	0.4	3.38		

¹ Slope = Change in Elev/ Length

² Velocity, based on Mannings Equation, $V = (1.486/n)R^{(2/3)} * S^{(1/2)}$, n= 0.013 for RCP and n=0.011 for PVC and HDPE, R= Hydraulic Radius, based on Q and SD size.

³ Travel Time = Length/Velocity/60, unless otherwise noted.

⁴ Intensity= Use Total Time and Exhibit M to determine I at 50 year storm frequency

⁵ Q (50 Year flowrate)= (ΣCA)* I

⁶ Initial time of concentration per Urban Areas Overland Time of Flow Curves, see Exhibit N.

See Calculations Below

50 Year Storm Event Hydrologic Calculations for Existing Conditions

Basin A

Mid City Skate Park JN 141021
Calcs By NF 9/10/2015

Q=CIA
C= 0.82 see Runoff Coefficient Calculations, Exhibit 'L'

Node 100 Elev= 335.2
Node 101 Elev=324.3
Length=270
Area= 1.08 Acres

Use Urban Watershed Curve Exhibit N
Ti=6.5 min
Per Exhibit M, I= 3.9 in/hr for 15 min. for 50 year storm event

Q= 0.82*3.9*1.08= 3.45 cfs at existing catch basin

Tc= Ti + Tf

Travel Time in the Pipe

Node 101 Elev=321.1
Node 102 Elev=318.9
Length= 100

Q=3.45 cfs

Per Manning's Equation: $V= 1.486/n * R^{(2/3)} * S^{(1/2)}$, for a pipe
Average Slope, S =2.0%
Mannings n for HDPE= 0.011
Existing 12" Storm Drain Pipe
Hydraulic Radius= Cross Section Wetted Area/Wetted Perimeter
Area= $(\theta - \sin\theta) d^2/8$, d= diameter, $\theta= 2\cos^{-1} [1-2 (y/d)]$, y= depth of flow
Perimeter= $\theta d/2$

Hydraflow Express Extension for Autodesk AutoCAD Civil 3d, was utilized to calculate the velocity in each conduit using mannings equation.

Velocity= 8.12 fps

Travel Time in Pipe= 100 ft/ 8.12 fps/60= 0.20 min.
Tc= 6.5 min. + 0.20min.= 6.7 min., I = 3.85 in/hr

Basin A2= 0.28 AC, C=0.56 (See Exhibit L)

$$Q_{50} = [(0.82 * 1.08) + (0.28 * 0.56)] * 3.85 = \underline{4.01 \text{ CFS}}$$

V50= 8.29 FPS

Travel Time in the Pipe

Node 102 Elev=318.9
Node 103 Elev=315.3
Length= 345

Although the Q50 from the drainage area delineated in this study will be 4.01 cfs at Node 103, the actual drainage area for this existing 24" storm drain is unknown. For a conservative travel time in the pipe, we will assume that the 24" storm drain is flowing at capacity, approximately 21 cfs.

Per Manning's Equation: $V = 1.486/n * R^{(2/3)} * S^{(1/2)}$, for a pipe

Average Slope, S =1.0%

Mannings n for concrete= 0.013

Existing 24" Storm Drain Pipe

Hydraulic Radius= Cross Section Wetted Area/Wetted Perimeter

Area= $(\theta - \sin\theta) d^2/8$, d= diameter, $\theta = 2\cos^{-1} [1-2 (y/d)]$, y= depth of flow

Perimeter= $\theta d/2$

Hydraflow Express Extension for Autodesk AutoCAD Civil 3d, was utilized to calculate the velocity in each conduit using the mannings equation.

Velocity= 7.98 fps

Travel Time in Pipe= 345 ft/ 7.98 fps/60= 0.70 min.
Tc= 6.7 min. + 0.7min.= 7.4 min., I = 3.7 in/hr

Basin A3= 3.19 AC, C=0.50

$$Q_{50} = [(0.82 * 1.08) + (0.28 * 0.56) + (3.19 * 0.50)] * 3.7 = \underline{9.76 \text{ CFS}}$$

Travel Time in the Pipe

Node 103 Elev=315.3
Node 104 (POCA) Elev=286
Length= 235

Although the Q50 from the drainage area delineated in this study will be 4.77 cfs at Node 103, the actual drainage area for this existing 24" storm drain is unknown. For a conservative travel time in the pipe, we will assume that the 24" storm drain is flowing at capacity at the steepest section, approximately 83 cfs.

Per Manning's Equation: $V = 1.486/n * R^{(2/3)} * S^{(1/2)}$, for a pipe
Average Slope, S =15.7% (steepest pipe section, down the slope in Caltrans Right-Of-Way)
Mannings n for concrete= 0.013
Existing 24" Storm Drain Pipe
Hydraulic Radius= Cross Section Wetted Area/Wetted Perimeter
Area= $(\theta - \sin\theta) d^2/8$, d= diameter, $\theta = 2\cos^{-1} [1 - 2(y/d)]$, y= depth of flow
Perimeter= $\theta d/2$

Hydraflow Express Extension for Autodesk AutoCAD Civil 3d, was utilized to calculate the velocity in each conduit using the mannings equation.

Velocity= 31.6 fps

Travel Time in Pipe= 235 ft/ 31.6 fps/60= 0.12 min.
Tc= 7.40 min. + 0.12min.= 7.52 min., I = 3.65 in/hr

Basin A4= 0.96 AC

Q50=[(0.82*1.08)+(0.28*0.56)+(3.19*0.50)+(0.96*0.50)]*3.65= **11.38 CFS**

Basin B

$$Q=CIA$$

C= 0.73 see Runoff Coefficient Calculations, Exhibit 'L'

Node 200 Elev= 331.7

Node 201 Elev=325.5

Length= 190

Area= 0.78 Acres

Use Urban Watershed Curve Exhibit N

Ti=7.8 min

Per Exhibit M, I= 3.5 in/hr for 7.8 min. for 50 year storm event

$$Q= 0.73*3.5*0.78= \underline{1.99 \text{ cfs}} \text{ at existing catch basin}$$

$$T_c = T_i + T_f$$

Travel Time in the Pipe

Node 201 Elev=322.7

Node 202 Elev=321.2

Length= 208

$$Q=1.99 \text{ CFS}$$

Per Manning's Equation: $V= 1.486/n * R^{(2/3)} * S^{(1/2)}$, for a pipe

Average Slope, S =0.72%

Mannings n for concrete= 0.013

Existing 18" Storm Drain Pipe

Hydraulic Radius= Cross Section Wetted Area/Wetted Perimeter

Area= $(\theta - \sin\theta) d^2/8$, d= diameter, $\theta= 2\cos^{-1} [1-2 (y/d)]$, y= depth of flow

Perimeter= $\theta d/2$

Hydraflow Express Extension for Autodesk AutoCAD Civil 3d, was utilized to calculate the velocity in each conduit using the mannings equation.

Velocity= 3.94fps

Travel Time in Pipe= 208 ft/ 3.94fps/60= 0.88 min.

Tc= 7.8 min. + 0.88 min.= 8.68 min., I = 3.4 in/hr

Basin B2= 0.58AC

$$Q_{50} = [(0.78 + 0.58) * 0.73] * 3.4 = \underline{\underline{3.38 \text{ CFS}}}$$

The existing 18" storm drain in the parking lot heading north into Landis Street was constructed per Caltrans Dwg. 11-048661. The V50 in the existing 18" storm drain is 8.08 fps.

Channel Report

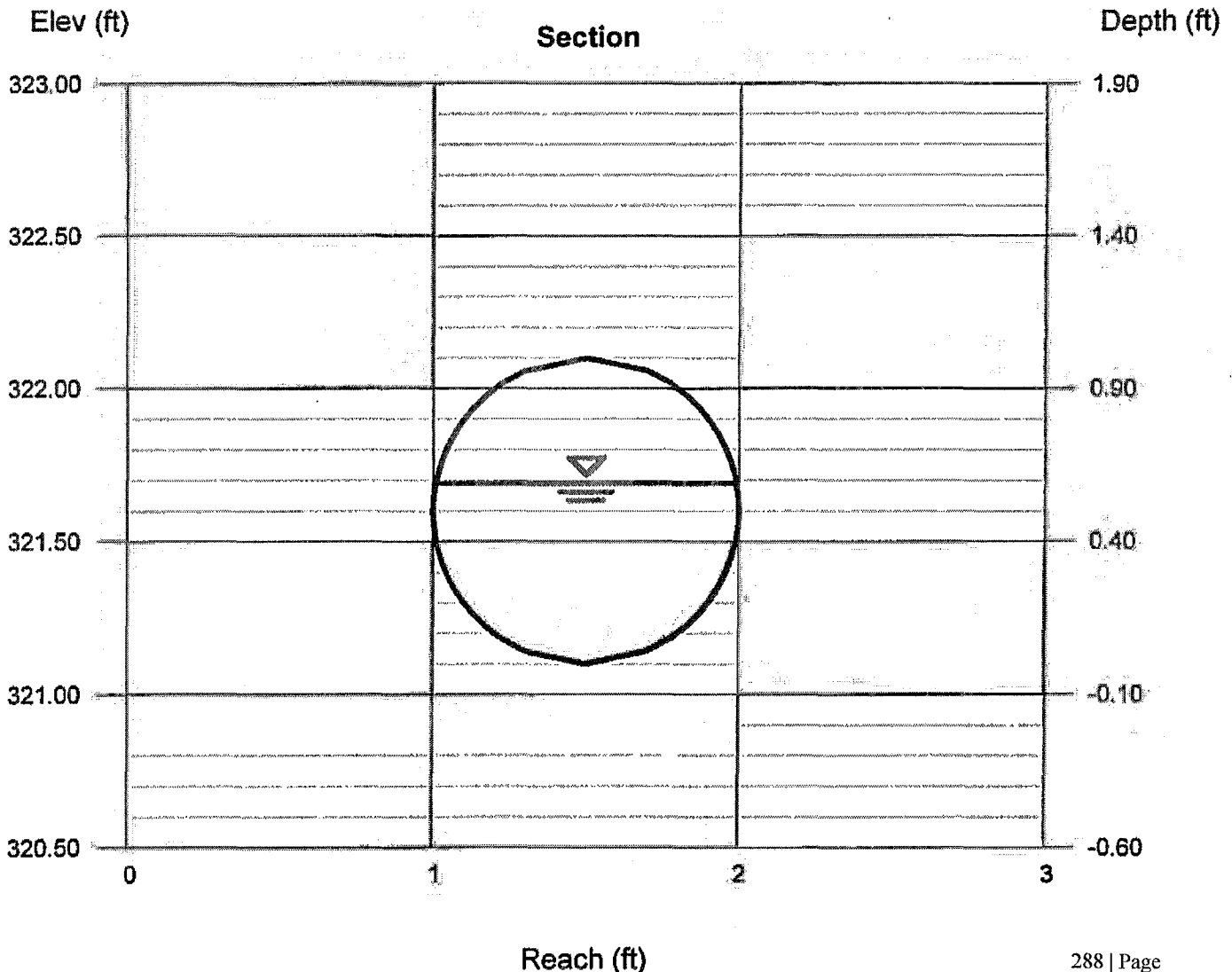
Basin A- Existing 12inch pipe Node 101 to 102

Circular
 Diameter (ft) = 1.00

 Invert Elev (ft) = 321.10
 Slope (%) = 2.20
 N-Value = 0.011

Highlighted
 Depth (ft) = 0.59
 Q (cfs) = 4.010
 Area (sqft) = 0.48
 Velocity (ft/s) = 8.29
 Wetted Perim (ft) = 1.75
 Crit Depth, Yc (ft) = 0.85
 Top Width (ft) = 0.98
 EGL (ft) = 1.66

Calculations
 Compute by: Known Q
 Known Q (cfs) = 4.01



Channel Report

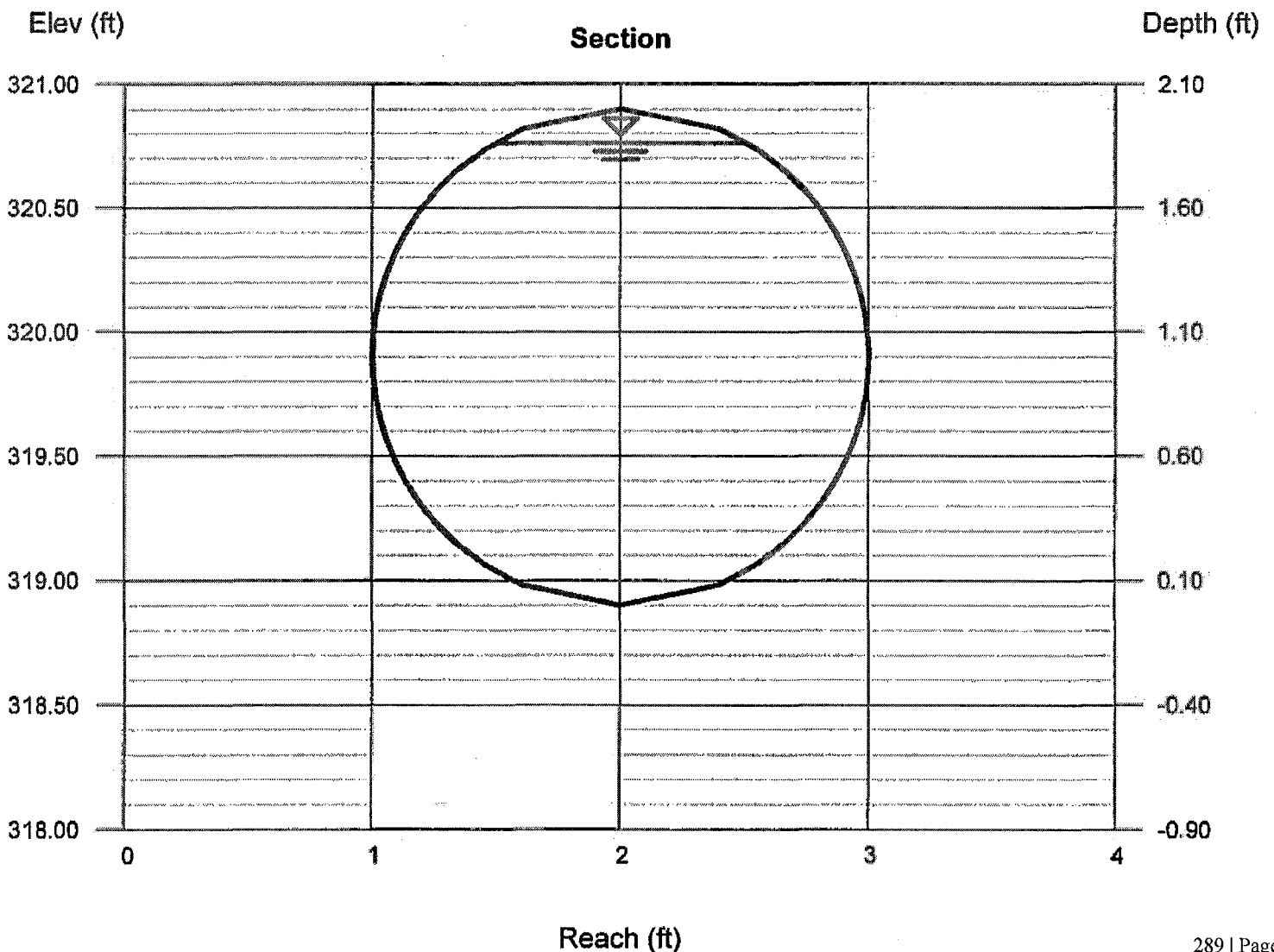
Existing 24inch pipe Node 102 to Node 103

Circular
Diameter (ft) = 2.00

Invert Elev (ft) = 318.90
Slope (%) = 1.10
N-Value = 0.013

Calculations
Compute by: Known Depth
Known Depth (ft) = 1.86

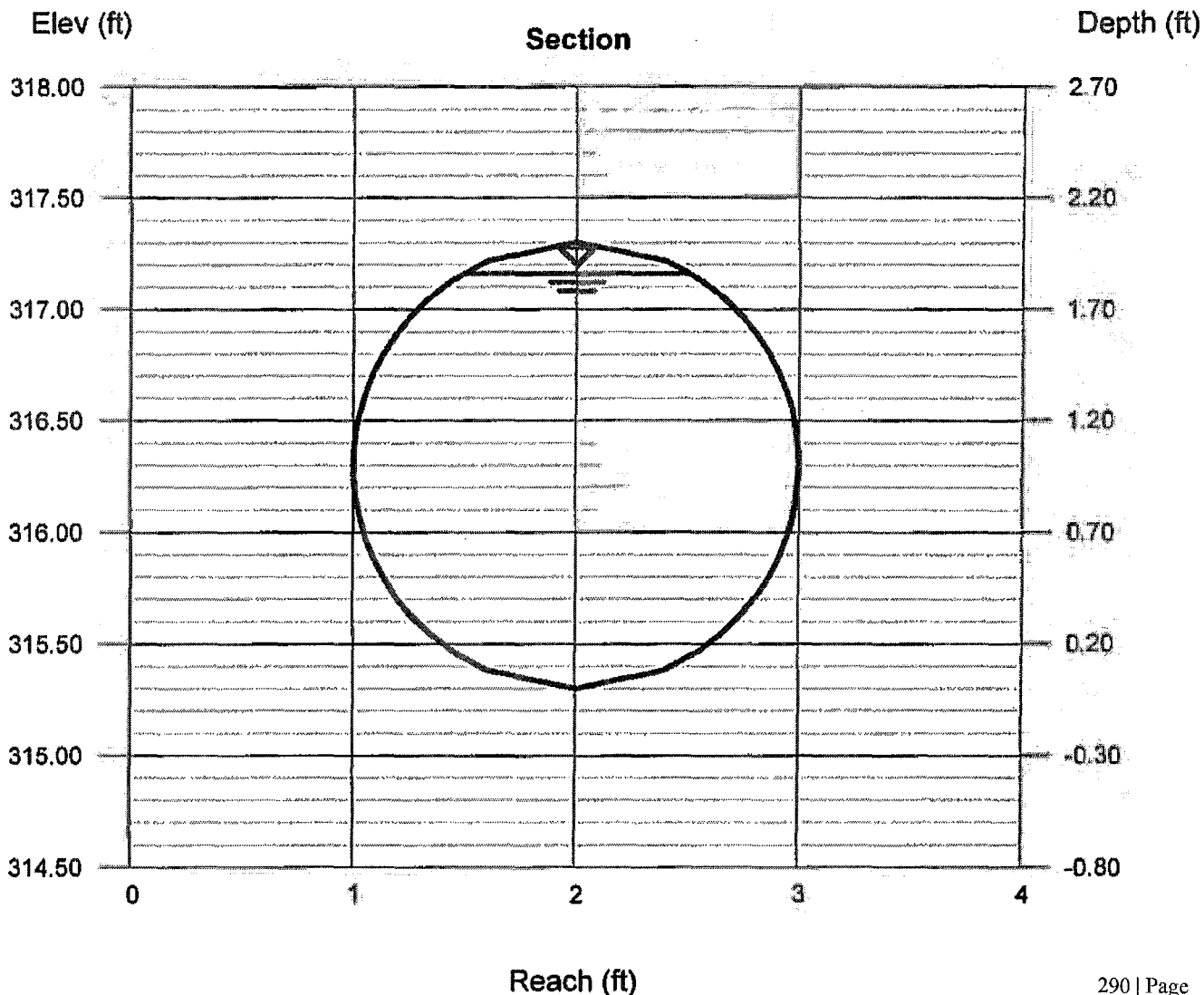
Highlighted
Depth (ft) = 1.86
Q (cfs) = 25.51
Area (sqft) = 3.05
Velocity (ft/s) = 8.37
Wetted Perim (ft) = 5.22
Crit Depth, Yc (ft) = 1.78
Top Width (ft) = 1.01
EGL (ft) = 2.95



Channel Report

Existing 24inch pipe Node 103 to Node 104 (POCA) at capacity

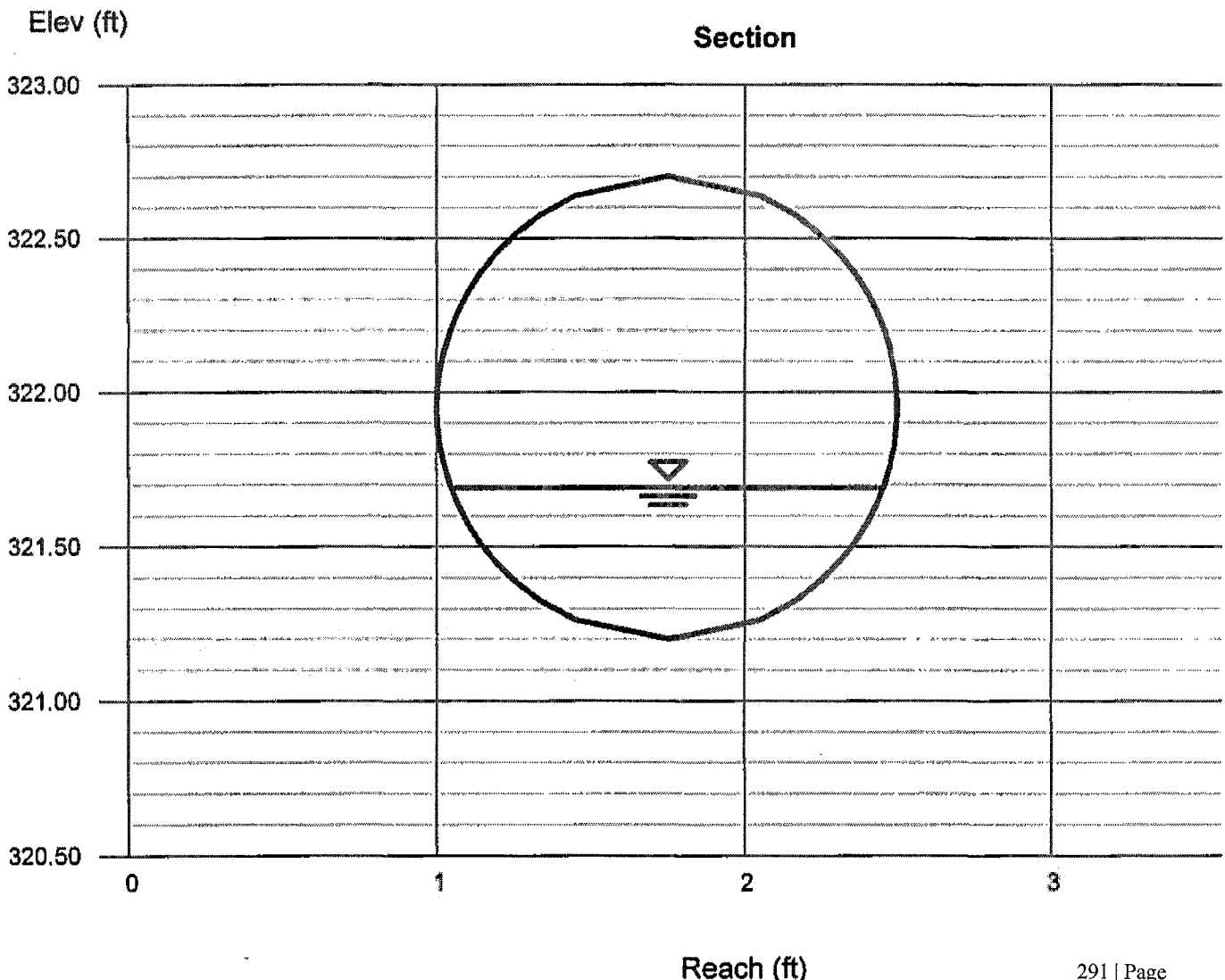
Circular		Highlighted	
Diameter (ft)	= 2.00	Depth (ft)	= 1.86
		Q (cfs)	= 96.37
		Area (sqft)	= 3.05
Invert Elev (ft)	= 315.30	Velocity (ft/s)	= 31.63
Slope (%)	= 15.70	Wetted Perim (ft)	= 5.22
N-Value	= 0.013	Crit Depth, Yc (ft)	= 2.00
		Top Width (ft)	= 1.01
		EGL (ft)	= 17.41
Calculations			
Compute by:	Known Depth		
Known Depth (ft)	= 1.86		



Channel Report

Basin B- Existing 18inch SD at Parking Lot

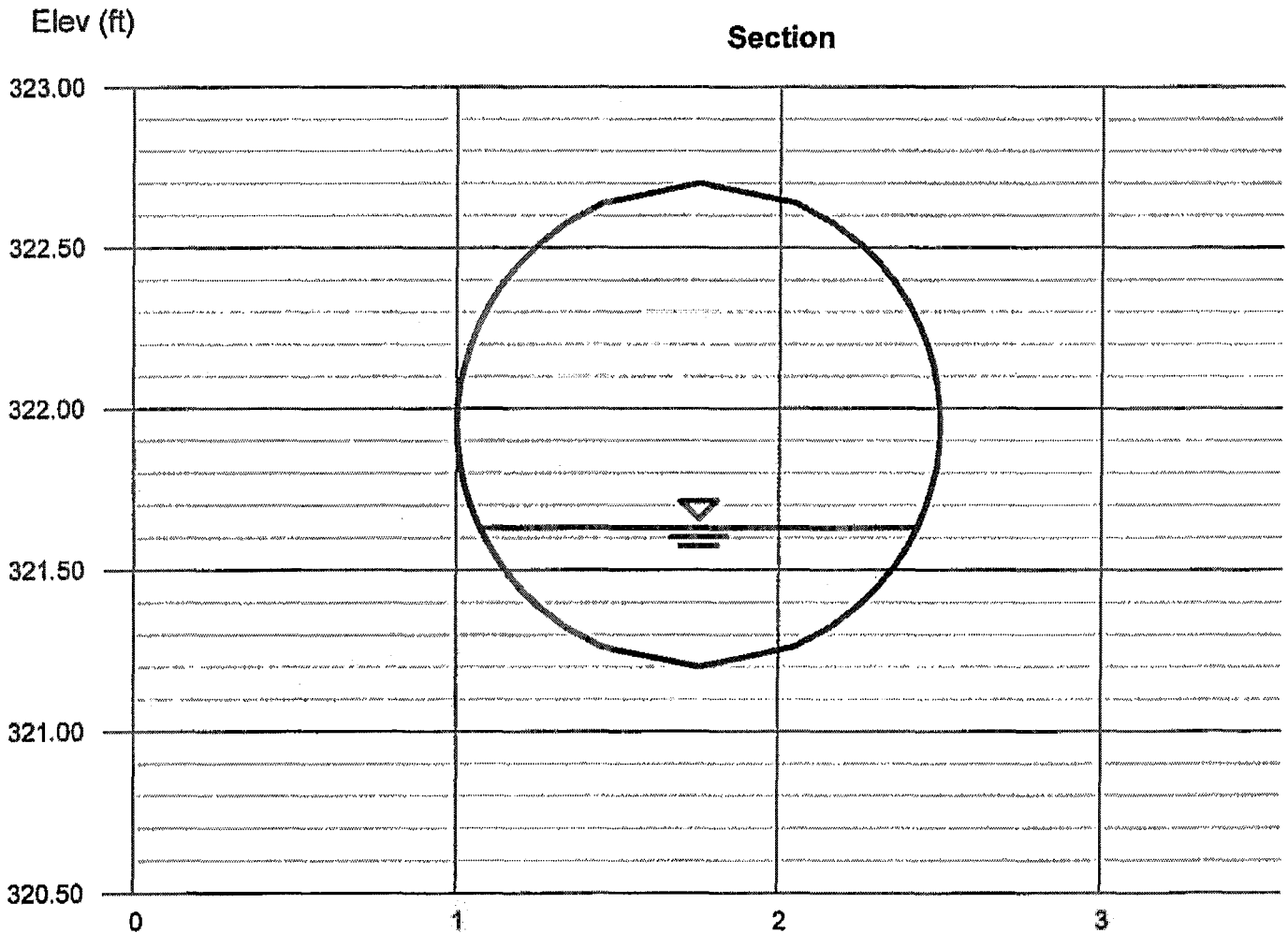
Circular		Highlighted	
Diameter (ft)	= 1.50	Depth (ft)	= 0.49
		Q (cfs)	= 1.990
		Area (sqft)	= 0.50
Invert Elev (ft)	= 321.20	Velocity (ft/s)	= 3.94
Slope (%)	= 0.72	Wetted Perim (ft)	= 1.83
N-Value	= 0.013	Crit Depth, Yc (ft)	= 0.54
		Top Width (ft)	= 1.41
Calculations		EGL (ft)	= 0.73
Compute by:	Known Q		
Known Q (cfs)	= 1.99		



Channel Report

Basin B- Existing 18inch SD Downstream of Parking Lot

Circular		Highlighted	
Diameter (ft)	= 1.50	Depth (ft)	= 0.43
		Q (cfs)	= 3.380
		Area (sqft)	= 0.42
Invert Elev (ft)	= 321.20	Velocity (ft/s)	= 8.08
Slope (%)	= 3.29	Wetted Perim (ft)	= 1.69
N-Value	= 0.013	Crit Depth, Yc (ft)	= 0.71
		Top Width (ft)	= 1.36
Calculations		EGL (ft)	= 1.44
Compute by:	Known Q		
Known Q (cfs)	= 3.38		



Appendix B

50 Year Proposed Hydrologic Calculations

Summary of Proposed 50 Year Hydrologic Calculations for Mid City Skate Park														
Basin C														
Description Process	NODE	ELEV	NODE	ELEV	Length	SLOPE ¹	Time ³ (min)	I ⁴ (in/hr)	AREA (AC)	C	AC	Q ⁵ cfs	Velocity (fps) ²	SD Size
Initial Area BASIN C1	300	335.2	301	324.3	270	4.0%	6.5 ⁶	3.9	1.08	0.82	0.9	3.45		
Travel Time	301	321.1	302	318.9	100	2.2%	0.2						8.12	12"
BASIN C2					Total Time =		6.7	3.85	0.28	0.56	0.2	4.01		
Travel Time	302	318.9	303	314.4	421	1.1%	0.8						8.37	24"
BASIN C3					Total Time =		7.5	3.65	3.02	0.5	1.5	9.32		
Travel Time	303	315.3	304	286	235	12.5%	0.1						31.6	24"
BASIN C4					Total Time =		7.6	3.65	0.71	0.50	0.4	10.61		
Basin D														
Description Process	NODE	ELEV	NODE	ELEV	Length	SLOPE ¹	Time ³ (min)	I ⁴ (in/hr)	AREA (AC)	C	AC	Q ⁵ cfs	Velocity (fps) ²	SD Size
Initial Area BASIN D1	400	328.4	401	325.5	130	2.2%	7.0 ⁶	3.7	0.66	0.69	0.5	1.68		
Travel Time	401	322.7	402	321.2	208	0.7%	0.9						3.76	18"
BASIN D2					Total Time =		7.9	3.4	0.70	0.69	0.5	3.19		
¹ Slope = Change in Elev/ Length ² Velocity, based on Mannings Equation, $V = (1.486/n)R^{2/3} S^{1/2}$, n= 0.013 for RCP and n=0.011 for PVC and HDPE, R= Hydraulic Radius, based on Q and SD size. ³ Travel Time = Length/Velocity/60, unless otherwise noted. ⁴ Intensity= Use Total Time and Exhibit C to determine I at 50 year storm frequency ⁵ Q (50 Year flowrate)= (ΣCA)* I ⁶ Initial time of concentration per Urban Areas Overland Time of Flow Curves, See Exhibit N.														

See Calculations Below

Basin C

Mid City Skate Park JN 141021
Calcs By NF 9/10/2015

$Q=CIA$

$C= 0.82$ see Runoff Coefficient Calculations, Exhibit 'L'

Node 300 Elev= 335.2

Node 301 Elev=324.3

Length= 270

Area= 1.08 Acres

Use Urban Watershed Curve Exhibit N

$T_i=6.5$ min

Per Exhibit M, $I= 3.9$ in/hr for 6.5 min. for 50 year storm event

$Q= 0.82*3.9*1.08= \underline{3.45}$ cfs at existing catch basin

$T_c= T_i + T_f$

Travel Time in the Pipe

Node 301 Elev=321.1

Node 302 Elev=318.9

Length= 100

$Q=3.45$ cfs

Per Manning's Equation: $V= 1.486/n * R^{(2/3)} * S^{(1/2)}$, for a pipe

Average Slope, $S =2.2\%$

Mannings n for HDPE= 0.011

Existing 12" Storm Drain Pipe

Hydraulic Radius= Cross Section Wetted Area/Wetted Perimeter

Area= $(\theta - \sin\theta) d^2/8$, $d=$ diameter, $\theta= 2\cos^{-1} [1-2 (y/d)]$, $y=$ depth of flow

Perimeter= $\theta d/2$

Hydraflow Express Extension for Autodesk AutoCAD Civil 3d, was utilized to calculate the velocity in each conduit using mannings equation.

Velocity= 8.12 fps

Travel Time in Pipe= $100 \text{ ft} / 8.12 \text{ fps} / 60 = 0.2$ min.

$T_c= 6.5 \text{ min.} + 0.2 \text{ min.} = 6.7 \text{ min.}$, $I = 3.85$ in/hr

Basin C2= 0.28 AC

$$Q50=[(0.82*1.08)+(0.28*0.56)]* 3.85= \underline{4.01 \text{ CFS}}$$

$$\underline{V50= 8.29 \text{ FPS}}$$

Travel Time in the Pipe

Node 302 Elev=318.9

Node 303 Elev=314.4

Length= 421

Although the Q50 from the drainage area delineated in this study will be 4.01 cfs at Node 103, the actual drainage area for this existing 24" storm drain is unknown. For a conservative travel time in the pipe, we will assume that the 24" storm drain is flowing at capacity, approximately 21 cfs.

Per Manning's Equation: $V= 1.486/n * R^{(2/3)} * S^{(1/2)}$, for a pipe

Average Slope, $S = 1.1\%$

Mannings n for concrete= 0.013

Existing 24" Storm Drain Pipe

Hydraulic Radius= Cross Section Wetted Area/Wetted Perimeter

Area= $(\theta - \sin\theta) d^2/8$, d = diameter, $\theta = 2\cos^{-1} [1-2 (y/d)]$, y = depth of flow

Perimeter= $\theta d/2$

Hydraflow Express Extension for Autodesk AutoCAD Civil 3d, was utilized to calculate the velocity in each conduit using the mannings equation.

$$\underline{\text{Velocity}= 8.37 \text{ fps}}$$

Travel Time in Pipe= 421 ft/ 8.37 fps/60= 0.84 min.

Tc= 6.7 min. + 0.84 min.= 7.5 min., I = 3.65 in/hr

Basin C3= 3.02 AC

$$Q50=[(1.08*0.82)+(0.28*0.56)+(3.02* .50)]*3.65= \underline{9.32 \text{ CFS}}$$

Travel Time in the Pipe

Node 303 Elev=314.4
Node 304 Elev=286
Length= 135

Although the Q50 from the drainage area delineated in this study will be 4.80 cfs at Node 303, the actual drainage area for this existing 24" storm drain is unknown. For a conservative travel time in the pipe, we will assume that the 24" storm drain is flowing at capacity at the steepest section, approximately 83 cfs.

Per Manning's Equation: $V = 1.486/n * R^{(2/3)} * S^{(1/2)}$, for a pipe

Average Slope, $S = 15.7\%$ (steepest pipe section, down the slope in Caltrans Right-Of-Way)

Mannings n for concrete= 0.013

Existing 24" Storm Drain Pipe

Hydraulic Radius= Cross Section Wetted Area/Wetted Perimeter

Area= $(\theta - \sin\theta) d^2/8$, d= diameter, $\theta = 2\cos^{-1} [1 - 2(y/d)]$, y= depth of flow

Perimeter= $\theta d/2$

Hydraflow Express Extension for Autodesk AutoCAD Civil 3d, was utilized to calculate the velocity in each conduit using the mannings equation.

Velocity= 31.6 fps

Travel Time in Pipe= $135 \text{ ft} / 31.6 \text{ fps} / 60 = 0.07 \text{ min.}$

$T_c = 7.6 \text{ min.} + 0.07 \text{ min.} = 7.7 \text{ min.}$, I = 3.65 in/hr

Basin C4 includes the skate park; however, since a 50gpm pump will be installed at the southwest end of the skate park most of the 50year storm water will be detained, only 0.11cfs will outflow. See Appendix G for separate skatepark hydrologic calcs and detention calculations.

$Q_{50} = [(1.08 * 0.82) + (0.28 * 0.56) + (3.02 * .50) + (0.71 * .50)] * 3.65 = \underline{\underline{10.61 \text{ CFS} + 0.11 \text{ CFS from the Skate Park via the Pump} = 10.72 \text{ CFS}}$

Basin D

D1

Q=CIA

C= 0.69 see Runoff Coefficient Calculations, Exhibit 'L'

Node 400 Elev= 328.4

Node 401 Elev=325.5

Length= 130

Area= 0.66 Acres

Use Urban Watershed Curve Exhibit N

Ti=7.0 min

Per Exhibit M, I= 3.7 in/hr for 7.0 min. for 50 year storm event

Q= 0.69*3.7*0.66= 1.68 cfs at existing catch basin

Tc= Ti + Tf

Travel Time in the Pipe

Node 401 Elev=322.7

Node 402 Elev=321.2

Length= 208

Q=1.68 CFS

Per Manning's Equation: $V = 1.486/n * R^{(2/3)} * S^{(1/2)}$, for a pipe

Average Slope, S =0.72%

Mannings n for concrete= 0.013

Existing 18" Storm Drain Pipe

Hydraulic Radius= Cross Section Wetted Area/Wetted Perimeter

Area= $(\theta - \sin\theta) d^2/8$, d= diameter, $\theta = 2\cos^{-1} [1-2 (y/d)]$, y= depth of flow

Perimeter= $\theta d/2$

Hydraflow Express Extension for Autodesk AutoCAD Civil 3d, was utilized to calculate the velocity in each conduit using the mannings equation.

Velocity= 3.76 fps

Travel Time in Pipe= 208 ft/ 3.76 fps/60= 0.92 min.

Tc= 7.0 min. + 0.92 min.= 7.9 min., I = 3.4 in/hr

Basin D2= 0.70AC

For Sub area Calculations for D2A and D2B, see below

$Q_{50} = [(0.66 + 0.70) * 0.69] * 3.4 = \underline{3.19 \text{ CFS}}$

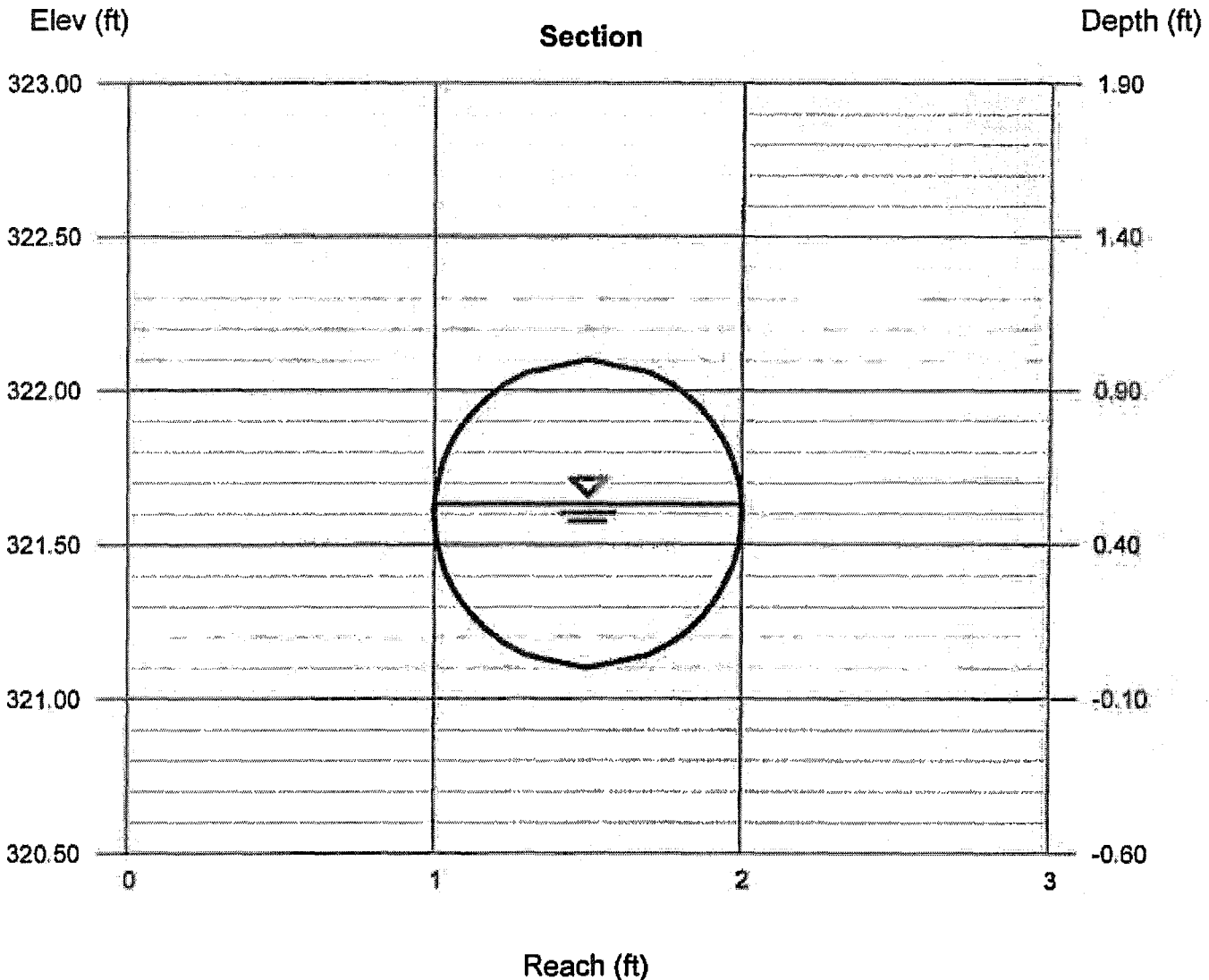
100 Year Storm Calculations for Basin C- SUB-BASIN CALCS FOR CB SIZING											
Description Process	NODE	ELEV	NODE	ELEV	Length	SLOPE	Time (min)	I (in/hr)	AREA (AC)	C	Q cfs
Basin C1A	305.1	326.7	305.2	324.7	80	2.5%	4.5	4.2	0.40	0.82	1.44
Basin C3A	306.1	326.2	306.2	321.7	160	2.8%	11.0	3.1	0.15	0.5	0.25
Basin C3B	307.1	325.5	307.2	321	172	2.6%	9.8	3.25	0.21	0.5	0.36
Basin C3C	308.1	329.5	308.2	320.8	350	2.5%	17	2.55	0.65	0.5	0.89
Basin C3D	309.1	322.5	309.2	321.3	115	1.0%	11.5	3.05	0.04	0.5	0.07
Basin C3E	402.1	330.2	310.2	320	415	2.5%	19	2.4	1.66	0.5	2.20
Basin C3F	311.1	321.2	311.2	320.2	90	1.1%	11	3.1	0.05	0.5	0.08
Basin C3G	312.1	328	312.2	322.7	68	7.8%	7	3.7	0.06	0.5	0.12
Basin C3H	313.1	328	313.2	321.3	165	4.1%	11	3.1	0.1	0.5	0.17
Basin C3I	314.1	328	314.2	320.5	155	4.8%	11	3.1	0.1	0.5	0.17
Basin C4A	320	333.5	320.1	320.5	283	4.6%	15	2.9	0.4	0.5	0.63
Basin C4B	314.1	328	321	319.6	85	9.9%	7	3.7	0.31	0.5	0.61

100 Year Storm Calculations for Basin D2- SUB-BASIN CALCS FOR CB SIZING											
Description Process	NODE	ELEV	NODE	ELEV	Length	SLOPE	Time (min)	I (in/hr)	AREA (AC)	C	Q cfs
BASIN D2A	402.1	330.2	402.2	326.8	160	2.1%	8.0	3.65	0.58	0.51	1.08
BASIN D2B	402.3	328.18	402.4	326.95	55	2.2%	3.0	4.4	0.12	0.8	0.42

Channel Report

Basin C- Node 301.0 to Node 302

Circular		Highlighted	
Diameter (ft)	= 1.00	Depth (ft)	= 0.53
		Q (cfs)	= 3.450
		Area (sqft)	= 0.42
Invert Elev (ft)	= 321.10	Velocity (ft/s)	= 8.12
Slope (%)	= 2.20	Wetted Perim (ft)	= 1.63
N-Value	= 0.011	Crit Depth, Yc (ft)	= 0.80
		Top Width (ft)	= 1.00
Calculations		EGL (ft)	= 1.56
Compute by:	Known Q		
Known Q (cfs)	= 3.45		



Channel Report

Basin C- Node 301.0 to Node 302

Circular

Diameter (ft) = 1.00

Invert Elev (ft) = 321.10

Slope (%) = 2.20

N-Value = 0.011

Calculations

Compute by: Known Q

Known Q (cfs) = 4.01

Highlighted

Depth (ft) = 0.59

Q (cfs) = 4.010

Area (sqft) = 0.48

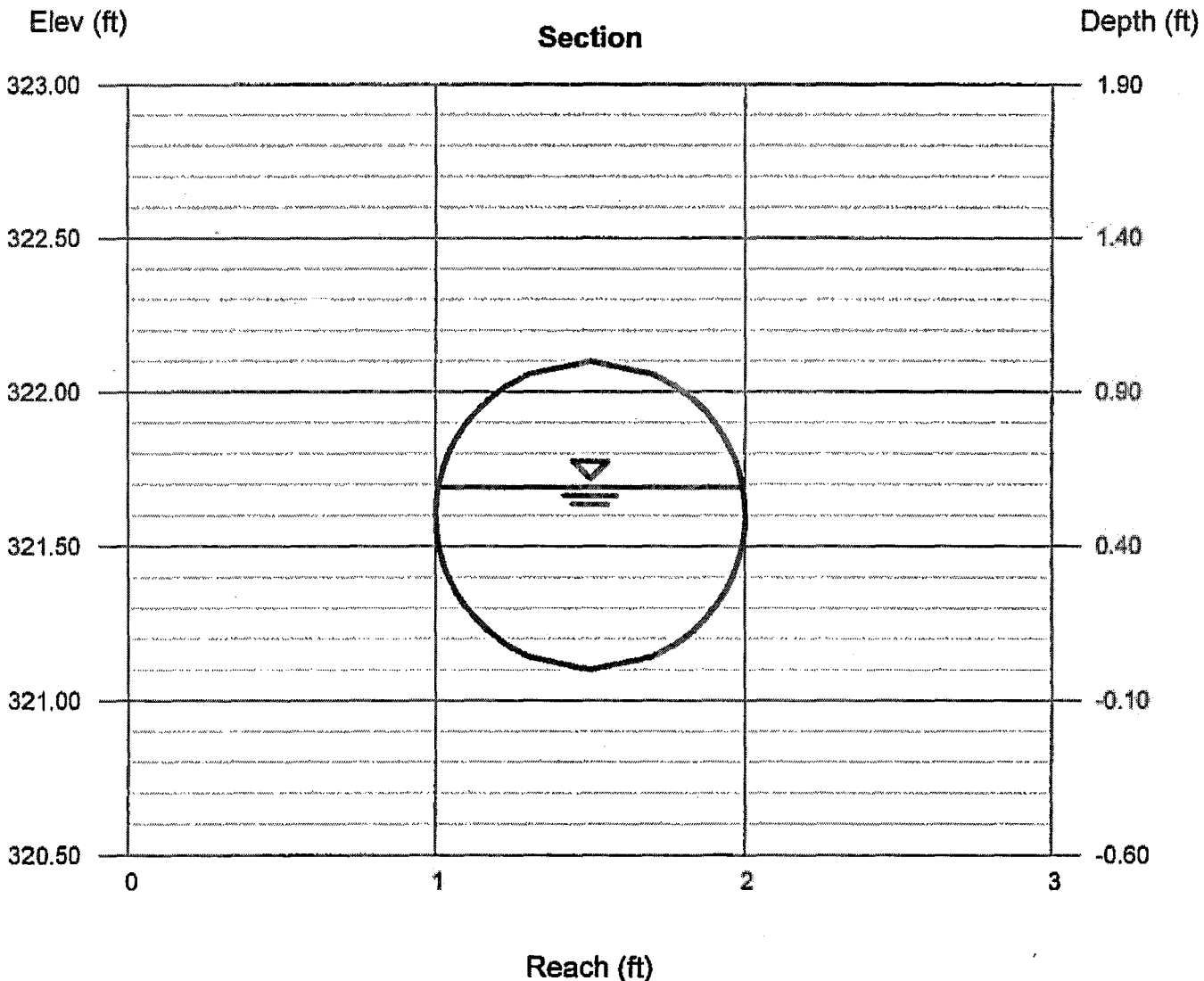
Velocity (ft/s) = 8.29

Wetted Perim (ft) = 1.75

Crit Depth, Y_c (ft) = 0.85

Top Width (ft) = 0.98

EGL (ft) = 1.66



Channel Report

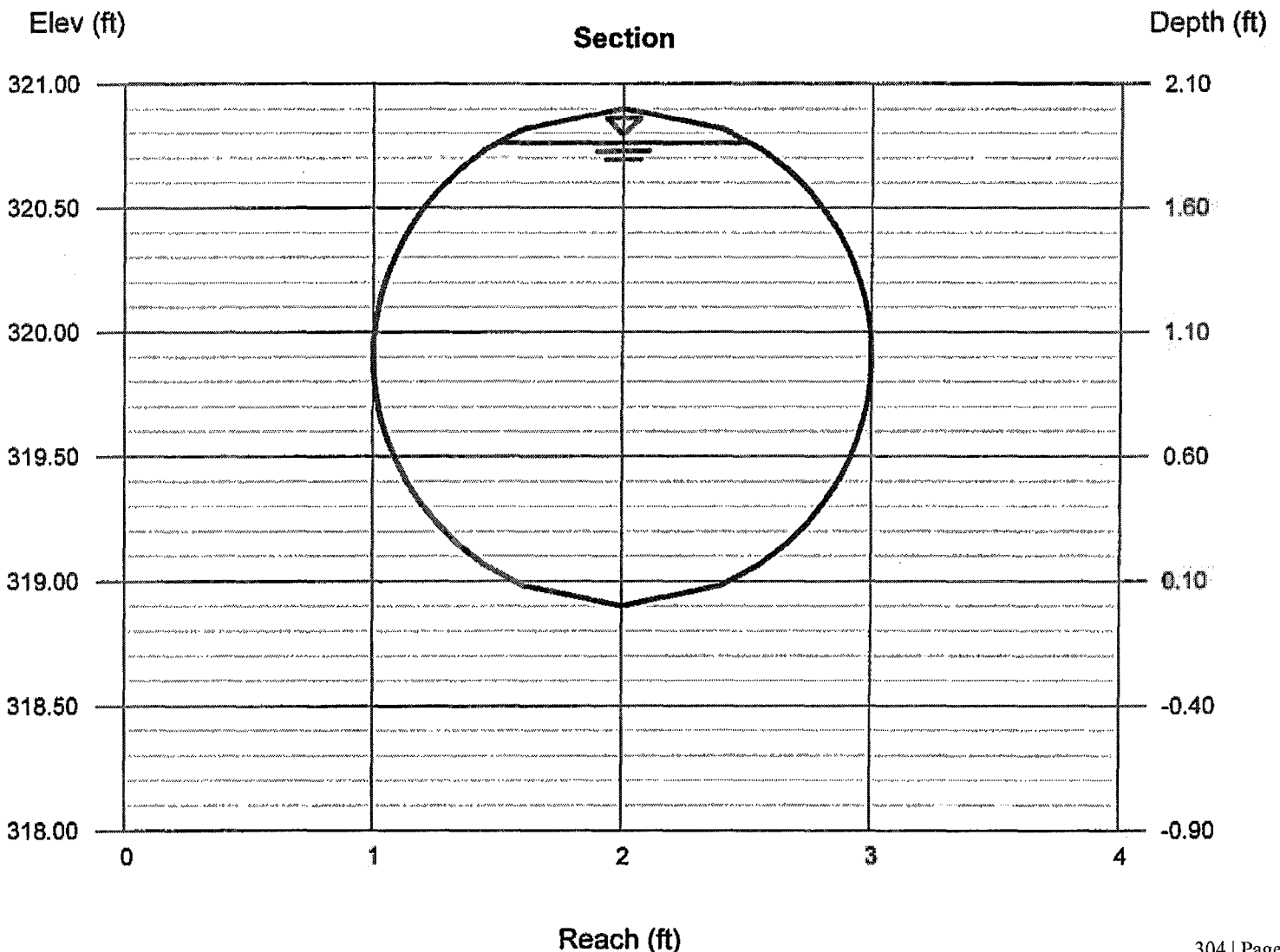
Basin C- Node 302 to Node 303

Circular
Diameter (ft) = 2.00

Invert Elev (ft) = 318.90
Slope (%) = 1.10
N-Value = 0.013

Calculations
Compute by: Known Depth
Known Depth (ft) = 1.86

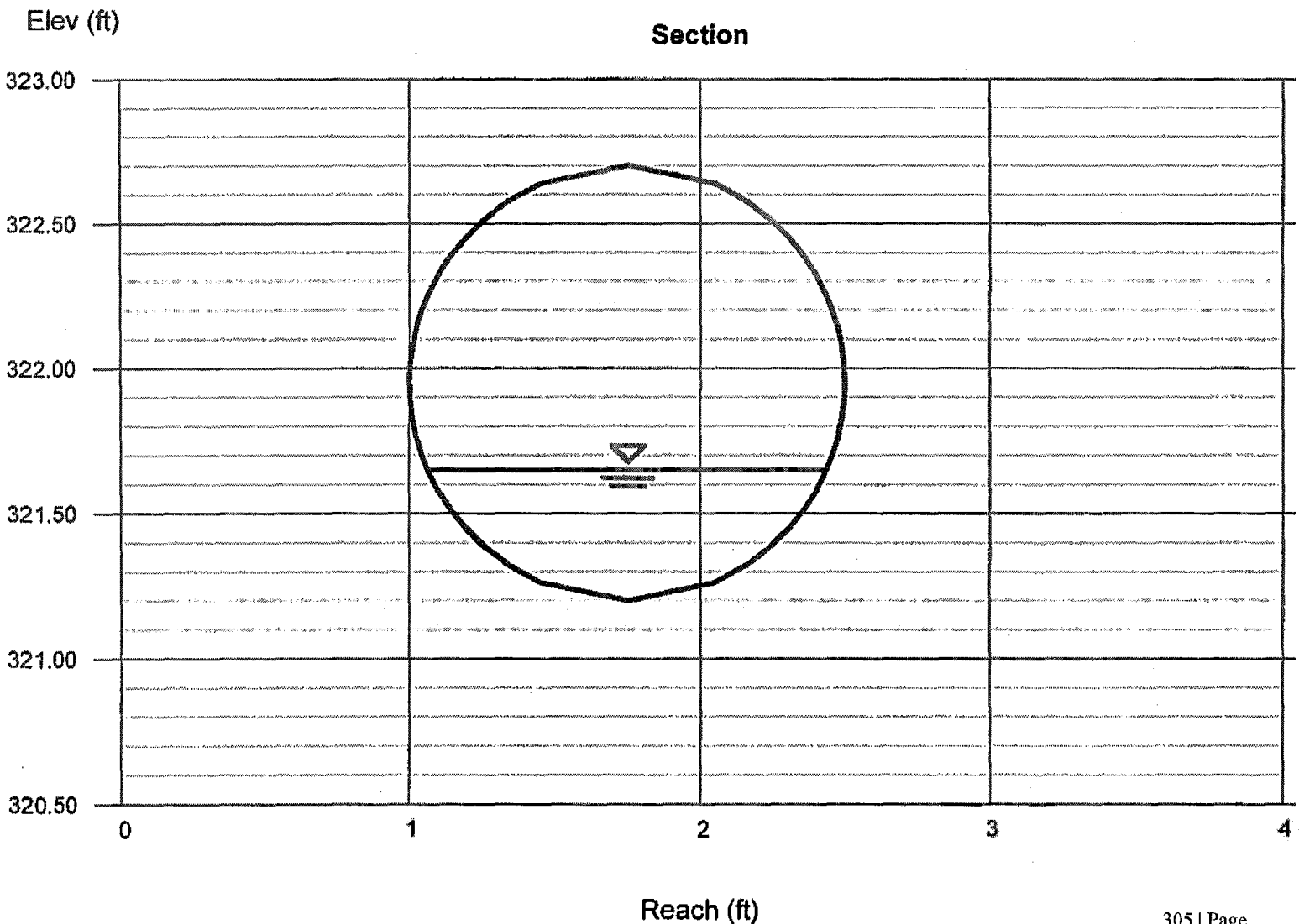
Highlighted
Depth (ft) = 1.86
Q (cfs) = 25.51
Area (sqft) = 3.05
Velocity (ft/s) = 8.37
Wetted Perim (ft) = 5.22
Crit Depth, Yc (ft) = 1.78
Top Width (ft) = 1.01
EGL (ft) = 2.95



Channel Report

Basin D Node 400 to Node 401

Circular		Highlighted	
Diameter (ft)	= 1.50	Depth (ft)	= 0.45
		Q (cfs)	= 1.680
		Area (sqft)	= 0.45
Invert Elev (ft)	= 321.20	Velocity (ft/s)	= 3.76
Slope (%)	= 0.72	Wetted Perim (ft)	= 1.74
N-Value	= 0.013	Crit Depth, Yc (ft)	= 0.49
		Top Width (ft)	= 1.38
		EGL (ft)	= 0.67
Calculations			
Compute by:	Known Q		
Known Q (cfs)	= 1.68		



Appendix C

Water Quality Calculations

Calculation of the Design Capture Volume (DCV) for Storm Water Pollutant Performance

Based on the 85th percentile map in Exhibit Q, the rain total for our project site = 0.62 inches, 0.62/12 = 0.052 ft of water.

Appendix B of the Model Design BMP Manual for the San Diego Region provides sizing methods for the DCV.

BMP 1

1. Determine the Weighted Run-Off Factor C

21065 sf Concrete
10415 sf Landscape

Per Table B-1.1 of the Model BMP Design Manual Run-off Factor for concrete is 0.90 and the Run-Off Factor for Landscape is 0.10 (See Exhibit Y)

$$C = \frac{(21065 * 0.90) + (10415 * 0.10)}{31480 \text{ sf}} = 0.64, \text{ so weighted C is } 0.64$$

2. Determine the Volume Required = Volume = Weighted Run-Off Factor* Depth of water in 85th percentile storm event* Area*1.5

$$0.64 * 0.052 * (31480) = 1040 * 1.5 = \underline{1,560 \text{ cf}}$$

3. Determine the Volume Provided, V_t = V₁ + V_f

$$V_1 = 0.50' * 1100 \text{ sf} = 550 \text{ cf}$$

V_f = Volume of storm water from a 6 hour storm. Since the media and aggregate infiltrate at 5 in/hr. the depth of water filtered during a 6 hour storm is 30".

$$1100 * (30" / 12) = 2,750 \text{ cf}$$

$$V_t = 550 \text{ cf} + 2,750 \text{ cf} = \underline{3,300 \text{ cf}}, \text{ exceeds minimum for water quality}$$

See below for Park De La Cruz- Water Quality Volume Calculations summary spreadsheet.

SURFACE TYPE	RUN-OFF FACTOR ¹	WEIGHTED C	P85th ²	DCV	DCV*1.5 ³	BMP AREA (SF) PROVIDED	Vf (CF)	PONDING DEPTH (FT)	V1 (CF)	SOIL DEPTH (FT)	GRAVEL DEPTH (FT)
CONCRETE	0.9	0.64	0.052	1040	1560	1100	2750	0.50	550	2.33	1
LANDSCAPE	0.1										
LANDSCAPE	0.1										
CONCRETE	0.9	0.58	0.052	67	101	39 ⁶	97.5	0.50	19.5	1.83	1
LANDSCAPE	0.1										
CONCRETE	0.9	0.60	0.052	52	79	30 ⁶	75.0	0.50	15	1.83	1
LANDSCAPE	0.1										
CONCRETE	0.9	0.32	0.052	151	227	87 ⁶	217.50	0.50	43.5	1.83	1
LANDSCAPE	0.1										
CONCRETE	0.9	0.32	0.052	396	593	420	1050	0.50	210	2.33	1
LANDSCAPE	0.1										
CONCRETE	0.9	0.59	0.052	196	294	170	425	0.50	85	2.33	1
LANDSCAPE	0.1										

¹ Model BMP Design Manual for the San Diego Region, June 2015, See Exhibit Y.

² pluviograph Map, 0.62 inch= .052ft.

³ 13-001, Provision E.3.c, biofiltration facilities must treat 1.5 times the design capture volume (DCV) if entire volume cannot be retained on the site.

⁴ Retention requirements for entire Basin A, see SWMM model in Appendix D.

⁵ Modification requirements for entire Basin B, see SWMM model in Appendix D.

⁶ Runoff reduction factor per Appendix B, Section B.5 of the Model BMP Design Manual, June 2015, for biofiltration performance.

According to the redevelopment rule the structural BMP performance requirements and hydromodification management requirements apply only to the creation or replacement of impervious surface and not to the entire development.

Drainage Basin A

The additional concrete on the west side of the existing walkway on the east side of the YMCA building will drain to the adjacent landscape area. It is infeasible to directly treat the replacement of the concrete walkway on the west side of the project a media filter will be installed in the existing catch basin just north of the tot lot. The small patio just north of the ball field drains towards a vegetated area. The biofiltration facilities are sized such that they treat the total volume and/or area required for the new or replaced impervious surface.

Drainage Basin B

It is infeasible to directly treat a few small areas of the parking lot. The biofiltration facilities are sized such that they treat the total volume and/or area required for the new or replaced impervious surface.

Appendix D
Continuous Simulation Modeling for Hydromodification

In order to meet the flow performance criteria in the City of San Diego Storm Water Standards Manual depicted in Section 7, continuous simulation modeling software was utilized.

In June 2015, the Model BMP Design Manual for the San Diego Region was published to replace the previous Countywide Model Standard Urban Stormwater Mitigation Plan (SUSMP) dated March 2011. Appendix G of the Model BMP Manual provides guidance for Continuous Simulation and Hydromodification Sizing Factors. This Appendix together with the Storm Water Management Model SWMM (developed by the USEPA) is utilized to provide hydrologic modeling to demonstrate compliance with the performance standards for hydromodification management in San Diego

Continuous Modeling

1. Climatology Parameters

A. Rainfall Data

Based on the Rainfall Gage Map, See Exhibit O, the project site is equal distance to the La Mesa Rain Gage, Lindbergh Field and Fashion Valley. The Fashion Valley rain gage is chosen because it has the most similar inches of rain on the Isopluvial Chart for the 50 Year, 6 hour flow rate (See Exhibit X).

The Fashion Valley Rainfall Data is from 1/2/1968 until 5/17/2008.

B. Evapotranspiration

The project site is in Zone 6 of the California Irrigation Management Information System, the values for evapotranspiration from Table G.1-1 of the BMP Model are depicted in Exhibit r.

Excerpts from Appendix G of the Manual are depicted in Exhibits S & T, which define parameters for the subcatchment input bioretention parameters utilized by the SWMM program.

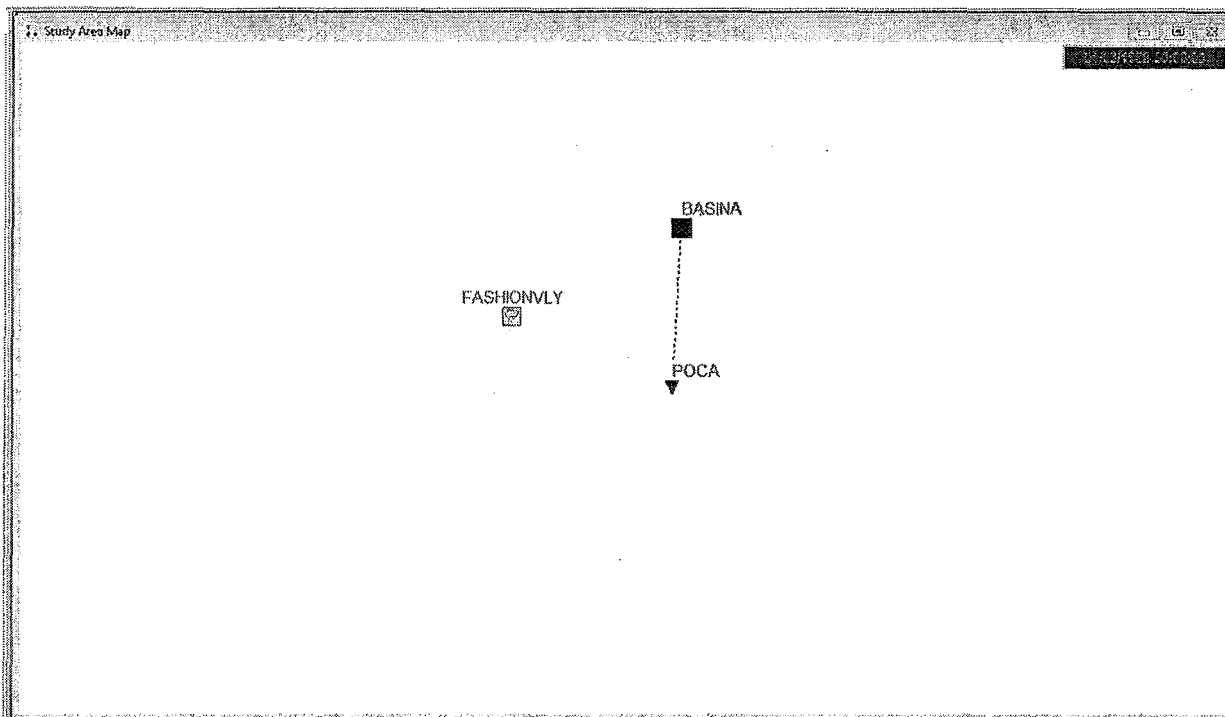
Basin A Subcatchment Input

According to the Redevelopment Rule (See Section 1.2.3) the structural BMP performance requirements and hydromodification management requirements apply only to the creation or replacement of impervious surface and not to the entire development.

Pre-developed Condition

See Exhibits U for the Pre-Developed Condition. The table below summarizes the subcatchment for the pre-developed conditions for Basin A.

Park De La Cruz Improvements					
SUBCATCHMENT INPUT FOR SWMM MODEL- PRE DEVELOPED CONDITIONS					
DRAINAGE AREA	DMA NAME	%IMPERVIOUS	SLOPE	AREA (SF)	Area (AC)
Pre-Developed A	BasinA	0	30.0%	37,805	0.868



Pre-project Flow Frequency - Long-term Simulation								
Mid City Skate Park- Pre-Developed Conditions- Basin A								
Statistics - Node POCA Total Inflow								
Rank	Start Date	Event Duration (hours)	Event Peak (CFS)	Exceedance Frequency (percent)	Return Period (years)			
1	2/20/1980	4	0.738	0.46	41	10-year Q:	0.623	cfs
2	1/31/1979	16	0.647	0.93	20.5	5-year Q:	0.546	cfs
3	12/28/2004	20	0.644	1.39	13.67	2-year Q:	0.396	cfs
4	11/16/1972	21	0.626	1.85	10.25			
5	12/4/1987	1	0.6	2.31	8.2			
6	3/11/1995	23	0.589	2.78	6.83	Lower Flow Threshold:	10%	
7	2/28/1970	2	0.582	3.24	5.86			
8	1/25/1995	16	0.553	3.7	5.13	0.1xQ2 (Pre):	0.040	cfs
9	10/27/2004	20	0.53	4.17	4.56			
10	3/4/2005	7	0.513	4.63	4.1			
11	1/9/1978	14	0.499	5.09	3.73			
12	3/8/1968	3	0.489	5.56	3.42			
13	2/3/1998	7	0.465	6.02	3.15			
14	11/5/1987	2	0.462	6.48	2.93			
15	12/4/1974	1	0.454	6.94	2.73			
16	2/14/1998	10	0.435	7.41	2.56			
17	2/8/1998	9	0.417	7.87	2.41			
18	1/31/1993	1	0.386	8.33	2.28			
19	3/1/1983	46	0.385	8.8	2.16			
20	2/25/2003	8	0.384	9.26	2.05			
21	2/17/1998	8	0.382	9.72	1.95			
22	2/23/1998	7	0.373	10.19	1.86			
23	2/28/1981	20	0.371	10.65	1.78			
24	2/12/2003	28	0.363	11.11	1.71			
25	1/6/1979	5	0.357	11.57	1.64			
26	3/17/1982	20	0.348	12.04	1.58			
27	11/17/1984	2	0.346	12.5	1.52			
28	2/21/2005	10	0.343	12.96	1.46			
29	11/22/1984	15	0.342	13.43	1.41			

30	3/6/1975	3	0.323	13.89	1.37				
31	1/14/1969	8	0.293	14.35	1.32				
32	2/25/1981	1	0.292	14.81	1.28				
33	5/8/1977	10	0.289	15.28	1.24				
34	1/9/2005	6	0.286	15.74	1.21				
35	12/25/1988	3	0.272	16.2	1.17				
36	1/4/1995	7	0.265	16.67	1.14				
37	1/11/2001	34	0.263	17.13	1.11				
38	11/25/1983	3	0.26	17.59	1.08				
39	2/8/1976	8	0.259	18.06	1.05				
40	1/18/1993	16	0.255	18.52	1.02				
41	3/2/1992	8	0.251	18.98	1				
42	1/10/1995	46	0.245	19.44	0.98				
43	2/6/1969	3	0.245	19.91	0.95				
44	12/31/1976	2	0.24	20.37	0.93				
45	2/23/2000	3	0.232	20.83	0.91				
46	3/11/1978	12	0.232	21.3	0.89				
47	10/19/2004	26	0.23	21.76	0.87				
48	2/11/2005	17	0.227	22.22	0.85				
49	1/14/1978	15	0.223	22.69	0.84				
50	1/26/2001	2	0.221	23.15	0.82				
51	3/25/1998	2	0.214	23.61	0.8				
52	4/20/1988	26	0.204	24.07	0.79				
53	2/15/1992	7	0.203	24.54	0.77				
54	12/6/1997	4	0.2	25	0.76				
55	3/15/2003	27	0.195	25.46	0.75				
56	2/17/1971	2	0.193	25.93	0.73				
57	1/9/1998	25	0.19	26.39	0.72				
58	11/22/1996	5	0.188	26.85	0.71				
59	4/28/2005	1	0.187	27.31	0.69				
60	1/13/1993	3	0.186	27.78	0.68				
61	1/5/1977	33	0.185	28.24	0.67				
62	1/16/1978	4	0.182	28.7	0.66				
63	11/29/1970	10	0.181	29.17	0.65				
64	3/5/1981	9	0.178	29.63	0.64				
65	2/8/1993	4	0.177	30.09	0.63				
66	2/21/2000	17	0.174	30.56	0.62				
67	1/11/2005	9	0.172	31.02	0.61				
68	2/22/2005	9	0.171	31.48	0.6				
69	12/16/1987	5	0.168	31.94	0.59				
70	4/7/1999	2	0.167	32.41	0.59				
71	2/2/1983	17	0.162	32.87	0.58				

72	12/24/1971	5	0.162	33.33	0.57				
73	2/18/1993	23	0.161	33.8	0.56				
74	1/15/1993	26	0.159	34.26	0.55				
75	2/19/2007	2	0.158	34.72	0.55				
76	3/20/1973	2	0.153	35.19	0.54				
77	1/12/1993	2	0.153	35.65	0.53				
78	4/12/1999	3	0.152	36.11	0.53				
79	10/26/1991	2	0.149	36.57	0.52				
80	2/14/1995	2	0.149	37.04	0.51				
81	1/29/1980	22	0.148	37.5	0.51				
82	2/7/1983	6	0.146	37.96	0.5				
83	8/17/1977	6	0.145	38.43	0.49				
84	3/19/1981	2	0.143	38.89	0.49				
85	4/8/1975	24	0.143	39.35	0.48				
86	3/17/1979	5	0.141	39.81	0.48				
87	2/12/1992	11	0.14	40.28	0.47				
88	3/23/1992	1	0.139	40.74	0.47				
89	11/23/1973	4	0.135	41.2	0.46				
90	1/3/2005	26	0.134	41.67	0.46				
91	2/12/1978	5	0.133	42.13	0.45				
92	12/19/1970	4	0.131	42.59	0.45				
93	1/4/1987	3	0.131	43.06	0.44				
94	1/23/2008	2	0.129	43.52	0.44				
95	2/6/1992	6	0.129	43.98	0.43				
96	3/22/2005	3	0.127	44.44	0.43				
97	10/30/1996	2	0.127	44.91	0.42				
98	3/5/1970	3	0.125	45.37	0.42				
99	12/25/2003	1	0.124	45.83	0.41				
100	2/10/1976	7	0.123	46.3	0.41				
101	3/20/1979	20	0.121	46.76	0.41				
102	3/19/1991	57	0.12	47.22	0.4				
103	1/6/1993	21	0.119	47.69	0.4				
104	4/18/1995	1	0.119	48.15	0.39				
105	3/10/1980	5	0.119	48.61	0.39				
106	11/10/1982	1	0.117	49.07	0.39				
107	11/25/1988	2	0.115	49.54	0.38				
108	12/29/1991	2	0.115	50	0.38				
109	1/7/2005	3	0.113	50.46	0.38				
110	1/25/1969	3	0.113	50.93	0.37				
111	2/22/2004	12	0.113	51.39	0.37				
112	12/21/1970	2	0.111	51.85	0.37				
113	3/6/1980	6	0.11	52.31	0.36				

114	3/4/1978	14	0.109	52.78	0.36			
115	1/17/1990	2	0.109	53.24	0.36			
116	3/11/2006	1	0.109	53.7	0.35			
117	2/11/1973	2	0.108	54.17	0.35			
118	12/27/1971	23	0.107	54.63	0.35			
119	11/11/1972	2	0.107	55.09	0.34			
120	2/26/2004	17	0.101	55.56	0.34			
121	12/7/1992	5	0.1	56.02	0.34			
122	2/10/1982	1	0.1	56.48	0.34			
123	3/18/1983	2	0.097	56.94	0.33			
124	11/13/1978	2	0.096	57.41	0.33			
125	1/25/1997	8	0.096	57.87	0.33			
126	11/28/1981	22	0.094	58.33	0.33			
127	2/15/1986	10	0.094	58.8	0.32			
128	1/29/1981	2	0.093	59.26	0.32			
129	4/1/1982	3	0.091	59.72	0.32			
130	1/14/1990	3	0.091	60.19	0.32			
131	1/12/1997	2	0.091	60.65	0.31			
132	1/4/1974	1	0.09	61.11	0.31			
133	3/11/1973	9	0.088	61.57	0.31			
134	12/29/1982	1	0.087	62.04	0.31			
135	4/14/2003	1	0.085	62.5	0.3			
136	2/22/1969	7	0.082	62.96	0.3			
137	12/11/1984	5	0.082	63.43	0.3			
138	11/24/1984	8	0.081	63.89	0.3			
139	3/15/1986	10	0.081	64.35	0.29			
140	2/22/2008	1	0.08	64.81	0.29			
141	3/25/1991	44	0.078	65.28	0.29			
142	3/5/2000	2	0.075	65.74	0.29			
143	3/24/1983	3	0.075	66.2	0.29			
144	3/14/1982	7	0.075	66.67	0.28			
145	5/1/1980	3	0.073	67.13	0.28			
146	1/7/1974	13	0.072	67.59	0.28			
147	3/28/1998	3	0.068	68.06	0.28			
148	12/21/1988	1	0.067	68.52	0.28			
149	3/5/1995	3	0.065	68.98	0.28			
150	3/10/1975	28	0.064	69.44	0.27			
151	2/16/1980	2	0.064	69.91	0.27			
152	1/7/2008	4	0.064	70.37	0.27			
153	2/6/1976	2	0.064	70.83	0.27			
154	1/27/1983	3	0.062	71.3	0.27			
155	2/18/1980	6	0.061	71.76	0.26			

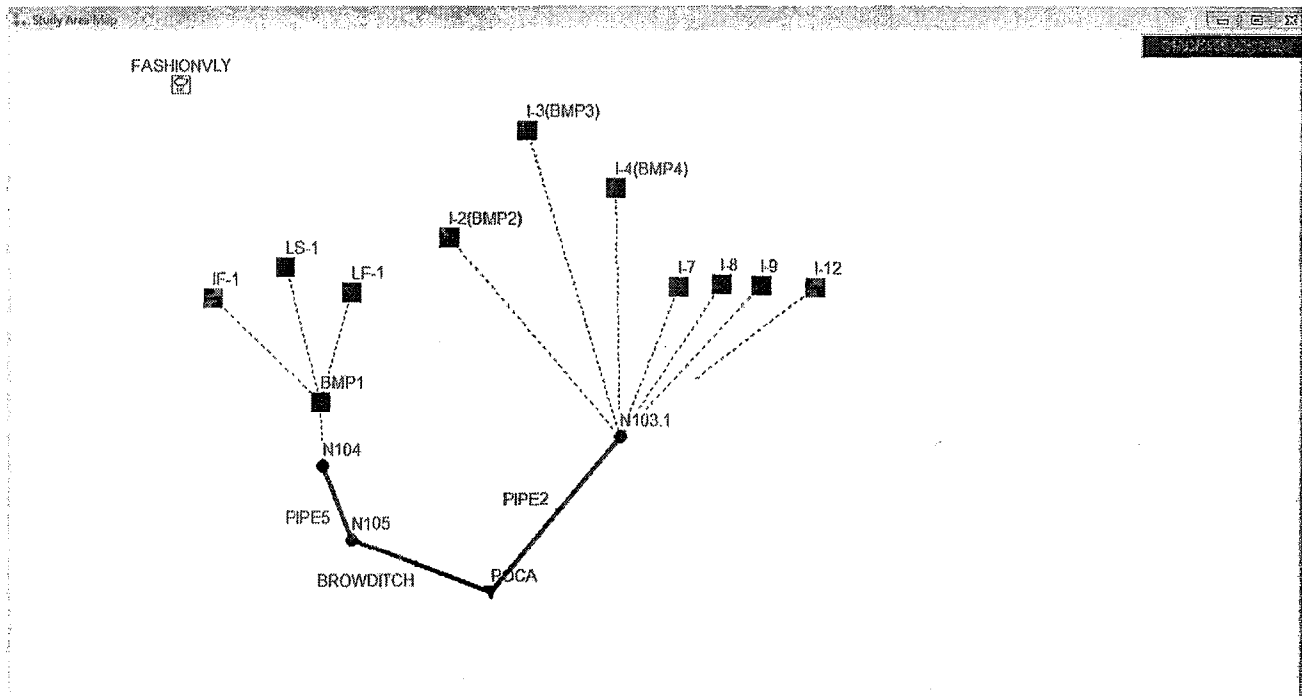
156	1/23/1997	2	0.06	72.22	0.26				
157	2/19/1969	8	0.06	72.69	0.26				
158	3/8/1975	4	0.059	73.15	0.26				
159	1/5/2008	1	0.056	73.61	0.26				
160	3/8/1974	8	0.055	74.07	0.26				
161	10/29/2000	2	0.054	74.54	0.25				
162	11/24/1978	5	0.051	75	0.25				
163	12/21/2002	2	0.051	75.46	0.25				
164	1/26/1969	2	0.046	75.93	0.25				
165	2/27/1983	16	0.046	76.39	0.25				
166	1/15/1998	3	0.046	76.85	0.25				
167	2/25/1969	4	0.045	77.31	0.25				
168	4/7/1978	2	0.041	77.78	0.24				
169	2/7/1976	2	0.041	78.24	0.24				
170	3/21/1983	1	0.04	78.7	0.24				
171	1/26/1999	11	0.04	79.17	0.24				
172	12/4/1972	2	0.039	79.63	0.24				
173	12/31/2004	2	0.037	80.09	0.24				
174	1/29/1983	4	0.037	80.56	0.24				
175	3/10/1978	3	0.035	81.02	0.23				
176	3/2/1970	1	0.035	81.48	0.23				
177	1/27/2008	8	0.033	81.94	0.23				
178	4/20/1983	2	0.032	82.41	0.23				
179	1/9/1980	2	0.031	82.87	0.23				
180	12/29/1992	1	0.03	83.33	0.23				
181	2/9/1981	1	0.03	83.8	0.23				
182	2/9/1992	3	0.029	84.26	0.23				
183	2/13/1973	1	0.029	84.72	0.22				
184	1/15/1979	2	0.026	85.19	0.22				
185	12/27/1984	6	0.024	85.65	0.22				
186	2/7/1994	17	0.023	86.11	0.22				
187	1/12/1980	2	0.023	86.57	0.22				
188	1/16/1970	2	0.022	87.04	0.22				
189	11/11/1985	6	0.021	87.5	0.22				
190	2/18/2005	2	0.02	87.96	0.22				
191	12/21/1997	2	0.02	88.43	0.21				
192	11/30/2007	1	0.02	88.89	0.21				
193	2/23/1993	2	0.02	89.35	0.21				
194	6/5/1993	1	0.019	89.81	0.21				
195	3/28/1979	6	0.017	90.28	0.21				
196	10/16/1971	1	0.016	90.74	0.21				
197	2/7/1978	1	0.014	91.2	0.21				

198	4/13/1976	3	0.013	91.67	0.21				
199	2/25/1987	1	0.013	92.13	0.21				
200	1/31/1996	5	0.012	92.59	0.2				
201	1/21/1969	1	0.012	93.06	0.2				
202	12/29/1977	1	0.011	93.52	0.2				
203	3/26/1980	1	0.01	93.98	0.2				
204	1/1/1982	1	0.01	94.44	0.2				
205	3/1/1978	5	0.009	94.91	0.2				
206	2/10/1978	1	0.009	95.37	0.2				
207	1/8/1995	1	0.009	95.83	0.2				
208	11/21/1978	1	0.008	96.3	0.2				
209	1/29/1998	1	0.006	96.76	0.2				
210	3/31/1978	2	0.006	97.22	0.2				
211	12/4/1971	1	0.006	97.69	0.19				
212	12/17/1978	2	0.005	98.15	0.19				
213	1/17/1988	1	0.002	98.61	0.19				
214	2/27/1991	1	0.002	99.07	0.19				
215	3/25/1989	1	0.002	99.54	0.19				

Basin A Proposed Condition

See Exhibit J for the proposed condition & BMP details. The table below summarizes the subcatchments for the proposed conditions for Basins A and Basin B.

Park De La Cruz Improvements					
SUBCATCHMENT INPUT FOR Basin A- SWMM MODEL- PROPOSED CONDITIONS					
DRAINAGE AREA	DMA NAME	%IMPERVIOUS	SLOPE	AREA (SF)	Area (AC)
A1	IF-1	100	1.0%	21065	0.484
	LS-1	0	33.0%	5070	0.116
	LF-1	0	1.0%	5345	0.097
I-2 TO BMP 2	I-2	100	1.0%	1340	0.031
I-3 TO BMP 3	I-3	100	1.0%	1050	0.024
1-4 TO BMP 4	I-4	100	1.0%	1505	0.035
I-7	I-7	100	1.0%	475	0.011
I-8	I-8	100	1.0%	1180	0.027
I-9	I-9	100	1.0%	50	0.001
I-12	I-12	100	1.0%	725	0.017
BMP 1	BMP1	0	0.0%	1100	0.025
Total					0.868



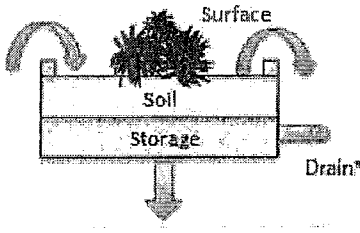
LID Input- Basin A

Park De La Cruz- Biofiltration Paramaters Summary					
BMP #	BMP AREA (SF) PROVIDED	PONDING DEPTH (FT)	V1 (CF)	SOIL DEPTH (FT)	GRAVEL DEPTH (FT)
1	1100	0.50	550	2.5	1

LID Control Editor

Control Name: **BIORETENTION**

LID Type: **Bio-Retention Cell**



*Optional

Surface	Soil	Storage	Drain
Berm Height (in. or mm)		6	
Vegetation Volume Fraction		0.0	
Surface Roughness (Mannings n)		0	
Surface Slope (percent)		0	

OK Cancel Help

LID Control Editor

Control Name: **BIORETENTION**

LID Type: **Bio-Retention Cell**

*Optional

Surface	Soil	Storage	Drain
Thickness (in. or mm)		30	
Porosity (volume fraction)		0.40	
Field Capacity (volume fraction)		0.2	
Wilting Point (volume fraction)		0.1	
Conductivity (in/hr or mm/hr)		5	
Conductivity Slope		5	
Suction Head (in. or mm)		1.5	

OK Cancel Help

LID Control Editor

Control Name: **BIORETENTION**

LID Type: **Bio-Retention Cell**

*Optional

Surface	Soil	Storage	Drain
Thickness (in. or mm)		12	
Void Ratio (Voids / Solids)		.67	
Seepage Rate (in/hr or mm/hr)		0	
Clogging Factor		0	

OK Cancel Help

LID Control Editor

Control Name: BIORETENTION

LID Type: Bio-Retention Cell

Surface	Soil	Storage	Drain
Flow Coefficient*		.1425	
Flow Exponent		0.5	
Offset Height (in. or mm)		0	
			<u>Drain Advisor</u>

*Optional

*Units are for flow in either in/hr or mm/hr; use 0 if there is no drain.

OK Cancel Help

SWMM Model Flow Coefficient Calculation

PARAMETER	ABBREV.	Bio-Retention Cell LID BMP	
Ponding Depth	PD	6	in
Bioretention Soil Layer	S	30	in
Gravel Layer	G	12	in
TOTAL		4.0	ft
		48	in
Orifice Coefficient	c_g	0.6	--
Low Flow Orifice Diameter	D	0.4375	in
Drain exponent	n	0.5	--
Flow Rate (volumetric)	Q	0.010	cfs
Ponding Depth Surface Area	A_{PD}	1100	ft ²
Bioretention Surface Area	A_S, A_G	1100	ft ²
	A_S, A_G	0.0253	ac
Porosity of Bioretention Soil	n	0.40	-
Flow Rate (per unit area)	q	0.985	in/hr
Effective Ponding Depth	PD_{eff}	6.00	in
Flow Coefficient	C	0.1425	--

Orifice Size and Flow Coefficient

BMP1

0.10Q2 = 0.04 cfs, this was an interpolation of the time-series analysis for the pre-developed conditions. See SWMM results summary.

Orifice Equation:

$$Q = C * A * (2gd)^{0.5}$$
$$A = \frac{Q}{C * (2gd)^{0.5}}$$

$$r = \sqrt{A/\pi}$$

$$C = 0.67$$

$$g = 32.2$$

d = head of water over orifice, 3.33

A = area of orifice

The maximum orifice size for this lower flow threshold will be 0.85 in. However, since some impervious surface is bypassing the BMP, a trial and error process yields an orifice size of 0.4375 inches in order to meet the flow performance criteria below.

Flow Control Performance Criteria:

a. For flow rates ranging from 10 percent of the pre-project 2-year run-off event to the pre-project 10 year run-off event, the post project discharge rates and durations shall not deviate above the pre-project rates and durations by more than 10 percent over and more than 10 percent of the length of the flow duration curve.

b. For flow rates ranging from the lower flow threshold to the 5-year runoff event, the post-project peak flows shall not exceed pre-project peak flows. For flow rates from Q5 to Q10, post roject peak flows may exceed pre-project flows by up to 10 percent for a 1-year frequency interval.

Determining the Flow Coefficient

Based on the SWMM manual the flow coefficient is based on the following formula:

$$q = C(h - H_d)^n$$

Where q = Unit Flow Rate (ft/s)

C = Flow coefficient

h = Pressure head acting on orifice (ft)

H_d = Drain Offset Height (ft)

n = Power Law Coefficient ($n=0.5$ to act like an orifice).

The unit flow rate $q = Q_{\text{orifice}} / (\eta A_{\text{lid}})$

Where Q_{orifice} = Volumetric Outflow Rate (cfs)

η = Engineered Soil Porosity

A_{lid} = Surface Area of LID

As mentioned above the Orifice Equation =

$$Q_{\text{orifice}} = C_o * A * (2gd)^{0.5}$$

Where $r = \sqrt{A/\pi}$

$C_o = 0.67$

$g = 32.2$

d = head of water over orifice

A = area of orifice

So, for 0.4375" diameter orifice, the $A = (0.4375/2/12)^2 * \pi = 0.00136\text{sf}$, $Q_{\text{orifice}} = 0.010\text{cfs}$

The Unit Flow Rate, $q = 0.010\text{cfs} / (0.40 * 1100\text{sf}) = 0.0000227\text{f/s} * 3600 * 12 = 0.981\text{ in/hr}$

Then the flow coefficient = $0.981\text{ in/hr} / (46\text{in})^{0.5} = 0.14$

Post-project (Mitigated) Flow Frequency - Long-term Simulation

Mid City Skate Park- Proposed Condition with BMP1 at SW Corner									
Statistics - Node POCA Total Inflow									
Rank	Start Date	Event Duration (hours)	Event Peak (CFS)	Exceedance Frequency (percent)	Return Period (years)				
1	2/13/1980	213	0.618	0.16	41			10-year Q:	0.547 cfs
2	12/28/2004	57	0.608	0.32	20.5			5-year Q:	0.494 cfs
3	1/31/1979	77	0.562	0.49	13.67			2-year Q:	0.293 cfs
4	1/23/1995	81	0.547	0.65	10.25				
5	12/4/1987	33	0.543	0.81	8.2				
6	3/4/2005	42	0.535	0.97	6.83			Lower Flow Threshold:	10%
7	2/28/1970	60	0.532	1.13	5.86				
8	12/4/1974	40	0.502	1.29	5.13			0.1xQ2 (Post Mit):	0.029 cfs
9	3/11/1995	50	0.479	1.46	4.56				
10	10/27/2004	56	0.463	1.62	4.1				
11	11/16/1972	53	0.456	1.78	3.73				
12	2/3/1998	52	0.453	1.94	3.42				
13	3/8/1968	36	0.44	2.1	3.15				
14	1/5/1979	56	0.414	2.27	2.93				
15	2/21/2005	83	0.37	2.43	2.73				
16	3/14/1982	132	0.361	2.59	2.56				
17	1/14/1969	49	0.359	2.75	2.41				
18	2/14/1998	161	0.333	2.91	2.28				
19	3/2/1992	50	0.311	3.07	2.16				
20	1/3/1995	74	0.309	3.24	2.05				
21	2/6/1998	91	0.284	3.4	1.95				
22	1/10/1995	79	0.267	3.56	1.86				
23	1/14/1978	126	0.258	3.72	1.78				
24	11/21/1996	47	0.247	3.88	1.71				
25	3/5/1975	91	0.22	4.05	1.64				
26	2/3/1976	200	0.21	4.21	1.58				
27	8/16/1977	51	0.201	4.37	1.52				
28	11/4/1987	49	0.2	4.53	1.46				
29	2/28/1981	62	0.2	4.69	1.41				
30	2/20/2000	115	0.197	4.85	1.37				

31	1/4/1987	84	0.196	5.02	1.32					
32	1/9/1978	55	0.187	5.18	1.28					
33	1/27/1980	82	0.186	5.34	1.24					
34	2/27/1983	177	0.186	5.5	1.21					
35	10/19/2004	69	0.179	5.66	1.17					
36	2/13/1995	59	0.179	5.83	1.14					
37	1/12/1993	173	0.161	5.99	1.11					
38	12/16/1987	47	0.156	6.15	1.08					
39	2/7/1993	47	0.147	6.31	1.05					
40	2/11/2003	103	0.144	6.47	1.02					
41	2/6/1992	48	0.128	6.63	1					
42	2/18/1993	70	0.118	6.8	0.98					
43	1/31/1993	32	0.115	6.96	0.95					
44	2/2/1983	47	0.114	7.12	0.93					
45	3/5/1981	42	0.099	7.28	0.91					
46	2/25/1981	34	0.097	7.44	0.89					
47	2/25/2003	74	0.094	7.61	0.87					
48	4/28/2005	28	0.093	7.77	0.85					
49	2/15/1986	52	0.091	7.93	0.84					
50	2/22/1998	71	0.091	8.09	0.82					
51	5/8/1977	43	0.089	8.25	0.8					
52	11/16/1984	35	0.088	8.41	0.79					
53	1/6/1993	78	0.088	8.58	0.77					
54	2/16/1971	43	0.086	8.74	0.76					
55	1/2/1977	133	0.084	8.9	0.75					
56	12/30/1976	50	0.082	9.06	0.73					
57	11/11/1985	59	0.082	9.22	0.72					
58	11/21/1984	111	0.081	9.39	0.71					
59	2/6/1969	37	0.08	9.55	0.69					
60	11/25/1983	31	0.08	9.71	0.68					
61	3/25/1998	53	0.075	9.87	0.67					
62	2/10/2005	62	0.075	10.03	0.66					
63	12/24/1988	41	0.072	10.19	0.65					
64	3/9/1978	94	0.069	10.36	0.64					
65	1/11/2001	70	0.069	10.52	0.63					
66	1/7/2005	127	0.069	10.68	0.62					
67	2/19/2007	46	0.069	10.84	0.61					
68	3/20/1973	28	0.067	11	0.6					
69	1/26/2001	37	0.067	11.17	0.59					
70	11/25/1988	34	0.066	11.33	0.59					
71	1/4/1974	129	0.065	11.49	0.58					
72	10/26/1991	30	0.065	11.65	0.57					

73	11/10/1972	40	0.064	11.81	0.56				
74	11/9/1982	48	0.064	11.97	0.55				
75	10/26/1996	19	0.064	12.14	0.55				
76	6/5/1993	27	0.063	12.3	0.54				
77	4/20/1988	69	0.063	12.46	0.53				
78	1/12/1997	39	0.062	12.62	0.53				
79	4/14/2003	40	0.061	12.78	0.52				
80	2/12/1992	100	0.061	12.94	0.51				
81	10/16/1971	60	0.06	13.11	0.51				
82	3/5/1995	53	0.058	13.27	0.5				
83	12/4/1972	36	0.058	13.43	0.49				
84	2/9/1982	51	0.058	13.59	0.49				
85	4/6/1999	39	0.058	13.75	0.48				
86	3/19/1981	28	0.058	13.92	0.48				
87	3/18/1991	88	0.058	14.08	0.47				
88	2/22/2004	51	0.058	14.24	0.47				
89	1/8/1980	136	0.058	14.4	0.46				
90	4/11/1999	38	0.057	14.56	0.46				
91	1/23/2008	31	0.056	14.72	0.45				
92	2/27/1991	61	0.056	14.89	0.45				
93	3/23/1992	23	0.056	15.05	0.44				
94	11/28/1981	54	0.056	15.21	0.44				
95	1/13/1990	120	0.055	15.37	0.43				
96	11/30/2007	43	0.054	15.53	0.43				
97	12/6/1997	52	0.054	15.7	0.42				
98	12/19/1970	82	0.054	15.86	0.42				
99	1/5/2008	74	0.054	16.02	0.41				
100	12/25/2003	42	0.053	16.18	0.41				
101	1/3/2005	57	0.053	16.34	0.41				
102	3/15/2003	57	0.053	16.5	0.4				
103	12/3/1971	46	0.052	16.67	0.4				
104	1/9/1998	56	0.052	16.83	0.39				
105	3/10/1980	38	0.052	16.99	0.39				
106	3/25/1989	32	0.052	17.15	0.39				
107	12/7/1992	38	0.051	17.31	0.38				
108	1/28/1981	66	0.05	17.48	0.38				
109	3/17/1983	69	0.05	17.64	0.38				
110	3/11/2006	25	0.05	17.8	0.37				
111	12/24/1971	116	0.05	17.96	0.37				
112	1/4/1973	24	0.05	18.12	0.37				
113	1/27/1983	66	0.05	18.28	0.36				
114	11/22/1973	29	0.05	18.45	0.36				

115	2/11/1973	60	0.05	18.61	0.36					
116	11/12/1976	27	0.05	18.77	0.35					
117	12/29/1982	26	0.049	18.93	0.35					
118	4/1/1982	28	0.049	19.09	0.35					
119	3/22/2005	53	0.049	19.26	0.34					
120	3/6/1980	36	0.049	19.42	0.34					
121	2/6/1983	74	0.049	19.58	0.34					
122	12/17/1978	75	0.048	19.74	0.34					
123	2/12/1978	33	0.047	19.9	0.33					
124	3/1/1976	50	0.047	20.06	0.33					
125	10/30/1996	30	0.047	20.23	0.33					
126	1/25/1997	48	0.047	20.39	0.33					
127	1/23/1997	34	0.047	20.55	0.32					
128	3/24/1994	37	0.046	20.71	0.32					
129	10/14/2006	24	0.046	20.87	0.32					
130	11/25/1970	34	0.046	21.04	0.32					
131	4/14/1971	26	0.046	21.2	0.31					
132	4/20/2007	26	0.046	21.36	0.31					
133	2/26/2004	43	0.046	21.52	0.31					
134	5/5/2005	17	0.046	21.68	0.31					
135	1/17/1988	34	0.046	21.84	0.3					
136	2/8/1981	34	0.045	22.01	0.3					
137	2/27/1978	97	0.045	22.17	0.3					
138	12/28/1991	70	0.045	22.33	0.3					
139	11/28/1970	59	0.045	22.49	0.29					
140	11/21/1978	23	0.045	22.65	0.29					
141	12/30/1981	92	0.045	22.82	0.29					
142	4/18/1995	27	0.045	22.98	0.29					
143	3/4/1978	51	0.044	23.14	0.29					
144	1/24/1969	103	0.044	23.3	0.28					
145	12/31/2004	23	0.043	23.46	0.28					
146	3/30/1978	76	0.043	23.62	0.28					
147	12/21/1988	48	0.043	23.79	0.28					
148	2/9/1992	25	0.043	23.95	0.28					
149	2/18/1969	206	0.043	24.11	0.28					
150	3/4/1970	30	0.042	24.27	0.27					
151	4/5/1975	108	0.042	24.43	0.27					
152	11/18/1973	34	0.042	24.6	0.27					
153	6/9/1990	42	0.042	24.76	0.27					
154	3/25/1991	68	0.041	24.92	0.27					
155	1/25/1999	70	0.041	25.08	0.26					
156	3/25/1993	68	0.041	25.24	0.26					

157	10/29/2000	26	0.041	25.4	0.26					
158	12/10/1984	46	0.041	25.57	0.26					
159	2/22/2008	70	0.041	25.73	0.26					
160	3/20/1992	28	0.041	25.89	0.26					
161	3/7/1974	40	0.04	26.05	0.25					
162	3/17/1979	118	0.04	26.21	0.25					
163	4/1/2004	15	0.04	26.38	0.25					
164	4/7/1978	19	0.04	26.54	0.25					
165	3/15/1986	52	0.04	26.7	0.25					
166	3/11/1973	31	0.04	26.86	0.25					
167	2/10/1970	45	0.04	27.02	0.25					
168	3/27/1979	56	0.04	27.18	0.24					
169	5/22/2006	25	0.04	27.35	0.24					
170	2/2/1988	43	0.04	27.51	0.24					
171	3/21/1983	97	0.04	27.67	0.24					
172	4/13/1976	34	0.039	27.83	0.24					
173	12/26/1984	54	0.039	27.99	0.24					
174	2/17/1990	37	0.039	28.16	0.24					
175	12/27/1992	63	0.039	28.32	0.23					
176	2/18/2005	37	0.038	28.48	0.23					
177	12/28/1974	46	0.038	28.64	0.23					
178	2/23/1993	30	0.038	28.8	0.23					
179	12/22/1982	22	0.038	28.96	0.23					
180	3/5/2000	31	0.038	29.13	0.23					
181	4/14/1988	27	0.038	29.29	0.23					
182	3/1/1979	28	0.038	29.45	0.23					
183	10/25/1971	15	0.038	29.61	0.22					
184	3/25/1980	21	0.037	29.77	0.22					
185	12/20/2002	53	0.037	29.94	0.22					
186	3/10/1975	54	0.037	30.1	0.22					
187	12/17/1991	24	0.037	30.26	0.22					
188	12/15/1988	37	0.036	30.42	0.22					
189	10/17/2005	25	0.036	30.58	0.22					
190	11/17/1986	48	0.036	30.74	0.22					
191	2/4/1999	26	0.036	30.91	0.21					
192	3/28/1998	47	0.036	31.07	0.21					
193	5/1/1980	28	0.035	31.23	0.21					
194	12/28/1977	39	0.035	31.39	0.21					
195	4/6/1986	41	0.035	31.55	0.21					
196	12/11/1993	23	0.035	31.72	0.21					
197	12/6/1986	46	0.035	31.88	0.21					
199	11/30/1999	8	0.035	32.2	0.21					

199	2/29/1988	46	0.035	32.2	0.21					
200	3/12/1996	43	0.035	32.36	0.2					
201	10/11/1987	46	0.035	32.52	0.2					
202	1/16/1973	24	0.035	32.69	0.2					
203	10/28/1998	7	0.035	32.85	0.2					
204	2/27/2006	38	0.034	33.01	0.2					
205	4/1/1999	30	0.034	33.17	0.2					
206	9/23/1986	70	0.034	33.33	0.2					
207	4/16/1995	22	0.034	33.5	0.2					
208	4/4/2006	40	0.034	33.66	0.2					
209	2/7/1994	43	0.033	33.82	0.2					
210	10/19/1979	39	0.033	33.98	0.2					
211	1/31/1990	20	0.033	34.14	0.19					
212	2/23/1987	73	0.033	34.3	0.19					
213	1/21/1995	23	0.033	34.47	0.19					
214	1/31/1996	47	0.033	34.63	0.19					
215	3/21/1995	67	0.033	34.79	0.19					
216	11/13/1978	28	0.033	34.95	0.19					
217	9/5/1978	18	0.033	35.11	0.19					
218	4/4/1990	19	0.033	35.28	0.19					
219	1/15/1998	32	0.033	35.44	0.19					
220	5/7/1976	6	0.033	35.6	0.19					
221	2/17/1994	57	0.033	35.76	0.19					
222	12/14/1993	16	0.032	35.92	0.18					
223	2/7/1978	75	0.032	36.08	0.18					
224	4/19/1983	33	0.032	36.25	0.18					
225	1/2/1990	23	0.032	36.41	0.18					
226	1/9/1991	15	0.032	36.57	0.18					
227	1/7/1995	31	0.032	36.73	0.18					
228	1/26/2008	36	0.032	36.89	0.18					
229	10/28/1974	46	0.031	37.06	0.18					
230	3/26/1992	27	0.031	37.22	0.18					
231	1/15/1979	27	0.031	37.38	0.18					
232	11/24/1985	71	0.031	37.54	0.18					
233	1/18/1969	79	0.031	37.7	0.18					
234	2/24/1983	25	0.03	37.86	0.18					
235	1/20/1982	49	0.03	38.03	0.17					
236	1/21/1996	18	0.03	38.19	0.17					
237	12/9/1983	19	0.029	38.35	0.17					
238	11/24/1978	25	0.029	38.51	0.17					
239	2/21/1979	21	0.029	38.67	0.17					
240	12/21/1997	25	0.029	38.83	0.17					

241	12/23/1995	12	0.029	39	0.17				
242	1/28/2005	20	0.029	39.16	0.17				
244	2/3/2004	35	0.029	39.48	0.17				
244	11/1/1995	28	0.029	39.48	0.17				
245	3/21/2006	19	0.029	39.64	0.17				
247	3/25/1999	27	0.029	39.97	0.17				
247	3/16/2008	9	0.029	39.97	0.17				
248	2/18/2006	34	0.029	40.13	0.17				
249	4/28/1980	21	0.028	40.29	0.16				
250	9/3/1998	13	0.028	40.45	0.16				
251	9/22/1987	30	0.028	40.61	0.16				
252	4/17/2000	19	0.028	40.78	0.16				
253	9/26/1999	1	0.028	40.94	0.16				
254	3/28/2006	22	0.028	41.1	0.16				
255	4/6/1984	16	0.028	41.26	0.16				
256	2/3/1994	40	0.028	41.42	0.16				
257	2/14/2008	21	0.028	41.59	0.16				
258	11/28/1998	18	0.028	41.75	0.16				
259	1/3/1991	38	0.027	41.91	0.16				
260	11/28/1982	58	0.027	42.07	0.16				
261	2/8/1986	38	0.027	42.23	0.16				
262	2/6/1973	21	0.027	42.39	0.16				
263	11/20/1983	24	0.026	42.56	0.16				
264	3/7/1992	30	0.026	42.72	0.16				
265	1/29/1998	26	0.026	42.88	0.15				
266	3/8/1986	100	0.026	43.04	0.15				
267	12/5/1998	35	0.026	43.2	0.15				
268	12/7/2007	62	0.026	43.37	0.15				
269	4/1/1968	15	0.025	43.53	0.15				
270	5/28/1971	16	0.025	43.69	0.15				
271	4/17/1990	18	0.025	43.85	0.15				
272	11/11/1978	37	0.025	44.01	0.15				
273	12/31/2005	62	0.025	44.17	0.15				
274	12/25/1968	26	0.025	44.34	0.15				
275	11/14/1988	18	0.024	44.5	0.15				
276	12/28/1989	23	0.024	44.66	0.15				
277	9/10/1976	39	0.024	44.82	0.15				
278	3/28/1982	22	0.024	44.98	0.15				
279	9/16/1978	12	0.024	45.15	0.15				
280	10/21/1976	17	0.024	45.31	0.15				
281	1/16/1970	22	0.024	45.47	0.15				
282	12/24/1983	75	0.024	45.63	0.15				

283	12/16/1984	24	0.024	45.79	0.14					
284	12/8/1982	49	0.023	45.95	0.14					
285	12/9/1996	62	0.023	46.12	0.14					
286	2/12/2000	18	0.023	46.28	0.14					
287	10/26/2000	39	0.023	46.44	0.14					
288	12/18/1988	18	0.023	46.6	0.14					
289	4/3/1987	39	0.023	46.76	0.14					
290	1/25/1994	28	0.023	46.93	0.14					
291	1/8/2001	22	0.023	47.09	0.14					
292	11/24/2001	14	0.023	47.25	0.14					
293	11/14/1993	10	0.023	47.41	0.14					
295	1/21/2001	11	0.023	47.73	0.14					
295	12/4/1992	1	0.023	47.73	0.14					
298	2/28/2007	11	0.023	48.22	0.14					
298	2/3/2008	27	0.023	48.22	0.14					
298	2/22/2007	14	0.023	48.22	0.14					
299	3/17/2002	17	0.023	48.38	0.14					
300	12/19/1987	22	0.023	48.54	0.14					
301	10/22/1987	21	0.023	48.71	0.14					
303	3/3/2006	11	0.023	49.03	0.14					
303	3/11/1999	6	0.023	49.03	0.14					
304	10/11/2000	1	0.023	49.19	0.13					
305	3/31/1998	41	0.023	49.35	0.13					
306	1/16/1984	15	0.023	49.51	0.13					
307	4/17/1983	14	0.023	49.68	0.13					
308	5/28/1990	27	0.022	49.84	0.13					
309	1/18/1973	23	0.022	50	0.13					
310	4/22/2001	11	0.022	50.16	0.13					
311	11/29/1985	37	0.022	50.32	0.13					
313	8/17/1999	1	0.022	50.65	0.13					
313	8/14/1983	1	0.022	50.65	0.13					
314	12/7/1984	20	0.022	50.81	0.13					
315	2/5/1978	29	0.021	50.97	0.13					
316	11/12/2001	12	0.021	51.13	0.13					
317	2/18/2004	16	0.021	51.29	0.13					
318	11/8/1998	23	0.021	51.46	0.13					
319	10/28/1987	23	0.021	51.62	0.13					
320	11/27/1975	40	0.021	51.78	0.13					
321	3/16/1977	14	0.021	51.94	0.13					
322	2/25/1996	28	0.021	52.1	0.13					
323	1/30/1986	61	0.021	52.27	0.13					
324	2/4/1990	18	0.021	52.43	0.13					

325	11/26/1973	15	0.021	52.59	0.13					
326	4/26/2002	17	0.021	52.75	0.13					
327	3/6/1973	65	0.021	52.91	0.13					
328	1/30/1978	22	0.021	53.07	0.13					
329	12/13/1971	15	0.021	53.24	0.12					
330	12/18/1984	64	0.021	53.4	0.12					
331	3/21/1969	19	0.02	53.56	0.12					
332	4/25/1994	66	0.02	53.72	0.12					
333	1/19/1983	19	0.02	53.88	0.12					
334	10/9/1986	31	0.02	54.05	0.12					
335	3/25/1977	14	0.02	54.21	0.12					
336	12/22/1971	15	0.019	54.37	0.12					
337	10/31/1987	34	0.019	54.53	0.12					
338	4/17/2003	15	0.019	54.69	0.12					
339	4/14/2006	21	0.019	54.85	0.12					
340	2/9/1975	40	0.019	55.02	0.12					
341	1/29/2007	40	0.019	55.18	0.12					
342	1/2/2004	19	0.019	55.34	0.12					
343	12/8/1969	22	0.019	55.5	0.12					
344	12/25/1977	40	0.019	55.66	0.12					
345	11/27/1981	2	0.019	55.83	0.12					
346	1/3/1978	12	0.019	55.99	0.12					
347	2/2/1985	44	0.018	56.15	0.12					
348	3/13/1971	7	0.018	56.31	0.12					
349	12/21/2001	16	0.018	56.47	0.12					
350	11/15/1969	12	0.018	56.63	0.12					
351	1/5/1992	85	0.018	56.8	0.12					
352	12/18/1992	11	0.018	56.96	0.12					
353	12/29/2002	16	0.018	57.12	0.12					
354	3/28/1990	17	0.018	57.28	0.12					
355	4/26/1971	4	0.018	57.44	0.12					
356	11/6/1969	33	0.018	57.61	0.12					
357	2/9/1989	21	0.018	57.77	0.11					
358	3/31/1992	41	0.018	57.93	0.11					
359	3/25/1982	26	0.018	58.09	0.11					
360	8/7/1983	2	0.017	58.25	0.11					
361	1/18/1979	23	0.017	58.41	0.11					
362	12/19/1990	40	0.017	58.58	0.11					
363	12/20/1986	23	0.017	58.74	0.11					
364	11/1/2003	8	0.017	58.9	0.11					
365	3/2/1980	15	0.017	59.06	0.11					
366	1/12/1971	12	0.017	59.22	0.11					

367	11/19/1982	10	0.017	59.39	0.11					
368	12/25/1994	17	0.017	59.55	0.11					
369	3/13/1991	42	0.017	59.71	0.11					
370	10/7/1983	14	0.017	59.87	0.11					
371	10/17/1984	2	0.017	60.03	0.11					
372	12/10/2006	6	0.017	60.19	0.11					
373	10/7/1985	21	0.017	60.36	0.11					
374	4/18/1996	11	0.017	60.52	0.11					
375	4/29/1983	12	0.017	60.68	0.11					
376	4/17/2004	10	0.017	60.84	0.11					
377	4/24/2002	2	0.017	61	0.11					
378	4/23/1990	11	0.017	61.17	0.11					
382	11/22/1993	11	0.017	61.81	0.11					
382	2/10/1997	9	0.017	61.81	0.11					
382	11/5/2001	8	0.017	61.81	0.11					
382	2/22/1996	8	0.017	61.81	0.11					
383	12/9/1970	16	0.017	61.97	0.11					
384	12/2/1985	34	0.017	62.14	0.11					
385	12/12/1975	22	0.017	62.3	0.11					
387	5/3/2003	11	0.017	62.62	0.11					
387	5/12/1998	10	0.017	62.62	0.11					
388	3/27/1974	11	0.016	62.78	0.11					
391	10/25/1989	13	0.016	63.27	0.1					
391	10/17/2004	1	0.016	63.27	0.1					
391	10/20/1984	11	0.016	63.27	0.1					
392	7/31/1991	7	0.016	63.43	0.1					
393	3/2/2004	18	0.016	63.59	0.1					
394	6/15/1995	19	0.016	63.75	0.1					
395	11/14/1972	15	0.016	63.92	0.1					
400	9/19/1989	2	0.016	64.72	0.1					
400	9/28/1982	1	0.016	64.72	0.1					
400	9/20/2005	1	0.016	64.72	0.1					
400	9/29/1983	1	0.016	64.72	0.1					
400	4/24/1994	2	0.016	64.72	0.1					
401	2/16/2000	15	0.016	64.89	0.1					
402	5/6/1995	1	0.016	65.05	0.1					
403	8/18/1999	4	0.016	65.21	0.1					
404	1/30/1975	24	0.016	65.37	0.1					
405	7/10/1996	1	0.016	65.53	0.1					
406	12/11/2007	12	0.016	65.7	0.1					
407	11/8/2002	34	0.016	65.86	0.1					
408	12/5/2004	60	0.016	66.02	0.1					

409	1/19/1998	15	0.015	66.18	0.1					
410	1/5/1978	11	0.015	66.34	0.1					
411	3/9/1969	21	0.015	66.5	0.1					
412	4/22/1980	34	0.015	66.67	0.1					
413	4/11/1998	13	0.015	66.83	0.1					
414	4/15/1978	6	0.015	66.99	0.1					
415	5/7/1971	19	0.015	67.15	0.1					
416	12/3/1983	11	0.015	67.31	0.1					
417	1/3/1998	32	0.015	67.48	0.1					
418	2/17/2002	11	0.015	67.64	0.1					
419	3/4/1996	16	0.015	67.8	0.1					
420	12/18/1977	19	0.015	67.96	0.1					
421	1/5/1982	24	0.015	68.12	0.1					
422	12/7/1972	52	0.015	68.28	0.1					
423	12/16/2006	22	0.015	68.45	0.1					
424	4/15/1998	13	0.015	68.61	0.1					
425	3/13/1969	19	0.014	68.77	0.1					
426	11/12/2003	16	0.014	68.93	0.1					
427	11/19/1990	27	0.014	69.09	0.1					
428	1/28/1982	18	0.014	69.26	0.1					
429	11/8/1984	14	0.014	69.42	0.1					
430	4/15/1976	9	0.014	69.58	0.1					
431	1/9/1970	23	0.014	69.74	0.1					
432	10/5/1977	21	0.014	69.9	0.09					
433	12/4/1980	15	0.013	70.06	0.09					
434	12/10/1985	32	0.013	70.23	0.09					
435	2/15/1973	7	0.013	70.39	0.09					
436	11/11/1983	37	0.013	70.55	0.09					
437	3/4/1969	6	0.013	70.71	0.09					
438	1/15/1995	50	0.013	70.87	0.09					
439	10/28/1981	2	0.013	71.04	0.09					
440	1/28/1985	25	0.013	71.2	0.09					
441	1/3/2002	9	0.013	71.36	0.09					
442	1/11/1981	28	0.013	71.52	0.09					
443	11/7/1979	14	0.013	71.68	0.09					
444	1/13/1998	12	0.012	71.84	0.09					
445	2/26/1993	11	0.012	72.01	0.09					
446	9/6/1972	14	0.012	72.17	0.09					
447	3/13/1986	21	0.012	72.33	0.09					
448	2/28/1973	11	0.012	72.49	0.09					
449	12/23/1977	10	0.011	72.65	0.09					
451	1/28/1979	6	0.011	72.98	0.09					

451	12/22/1973	5	0.011	72.98	0.09					
452	1/27/1968	26	0.011	73.14	0.09					
453	12/8/1991	9	0.011	73.3	0.09					
454	12/17/1970	13	0.011	73.46	0.09					
455	12/27/2006	8	0.011	73.62	0.09					
457	11/29/2002	10	0.011	73.95	0.09					
457	11/30/1997	2	0.011	73.95	0.09					
458	2/13/1987	16	0.011	74.11	0.09					
459	2/14/1979	7	0.011	74.27	0.09					
460	1/10/1982	16	0.011	74.43	0.09					
461	2/3/1975	51	0.011	74.6	0.09					
462	11/30/1993	7	0.011	74.76	0.09					
463	12/28/1996	7	0.011	74.92	0.09					
464	3/2/1974	2	0.011	75.08	0.09					
465	3/14/1979	1	0.011	75.24	0.09					
466	1/9/1973	14	0.011	75.4	0.09					
467	10/23/1991	2	0.011	75.57	0.09					
468	10/12/2007	34	0.011	75.73	0.09					
469	3/15/1999	10	0.011	75.89	0.09					
470	12/7/2003	21	0.011	76.05	0.09					
471	10/23/1992	1	0.011	76.21	0.09					
472	1/2/1993	12	0.011	76.38	0.09					
473	4/21/2001	11	0.011	76.54	0.09					
474	9/17/1985	27	0.011	76.7	0.09					
475	12/6/1996	15	0.011	76.86	0.09					
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477	1/5/1984	13	0.01	77.18	0.09					
478	2/2/1989	20	0.01	77.35	0.09					
479	1/7/1985	26	0.01	77.51	0.09					
480	3/22/1975	11	0.01	77.67	0.09					
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482	11/15/1968	10	0.01	77.99	0.09					
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485	1/24/1983	9	0.01	78.48	0.08					
486	2/27/1996	13	0.01	78.64	0.08					
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513	3/23/2002	1	0.009	83.01	0.08					
513	3/1/1985	1	0.009	83.01	0.08					
513	3/26/2008	3	0.009	83.01	0.08					
513	3/17/1968	1	0.009	83.01	0.08					
513	3/14/1975	7	0.009	83.01	0.08					
513	3/29/1985	1	0.009	83.01	0.08					
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539	1/16/1996	9	0.007	87.22	0.08					
540	3/26/1973	8	0.007	87.38	0.08					
541	1/5/1989	18	0.006	87.54	0.08					
542	2/28/1969	5	0.006	87.7	0.08					
543	1/25/1996	5	0.006	87.86	0.08					
544	12/10/2001	3	0.006	88.03	0.08					
545	4/1/1980	2	0.006	88.19	0.08					
546	7/28/1968	1	0.006	88.35	0.08					
547	1/2/1971	6	0.005	88.51	0.07					
548	11/10/1994	2	0.005	88.67	0.07					
549	12/11/2003	5	0.005	88.83	0.07					
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557	1/23/1989	1	0.005	90.13	0.07					
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558	10/16/1993	2	0.005	90.29	0.07					
559	1/23/1983	4	0.005	90.45	0.07					
560	3/21/2007	1	0.005	90.61	0.07					
561	1/4/1989	3	0.005	90.78	0.07					
564	11/18/1987	4	0.005	91.26	0.07					
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566	12/13/1995	1	0.005	91.59	0.07					
567	4/18/1985	12	0.005	91.75	0.07					
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570	3/21/1987	1	0.005	92.23	0.07					
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571	2/23/1979	5	0.005	92.39	0.07					
573	10/22/1985	1	0.005	92.72	0.07					
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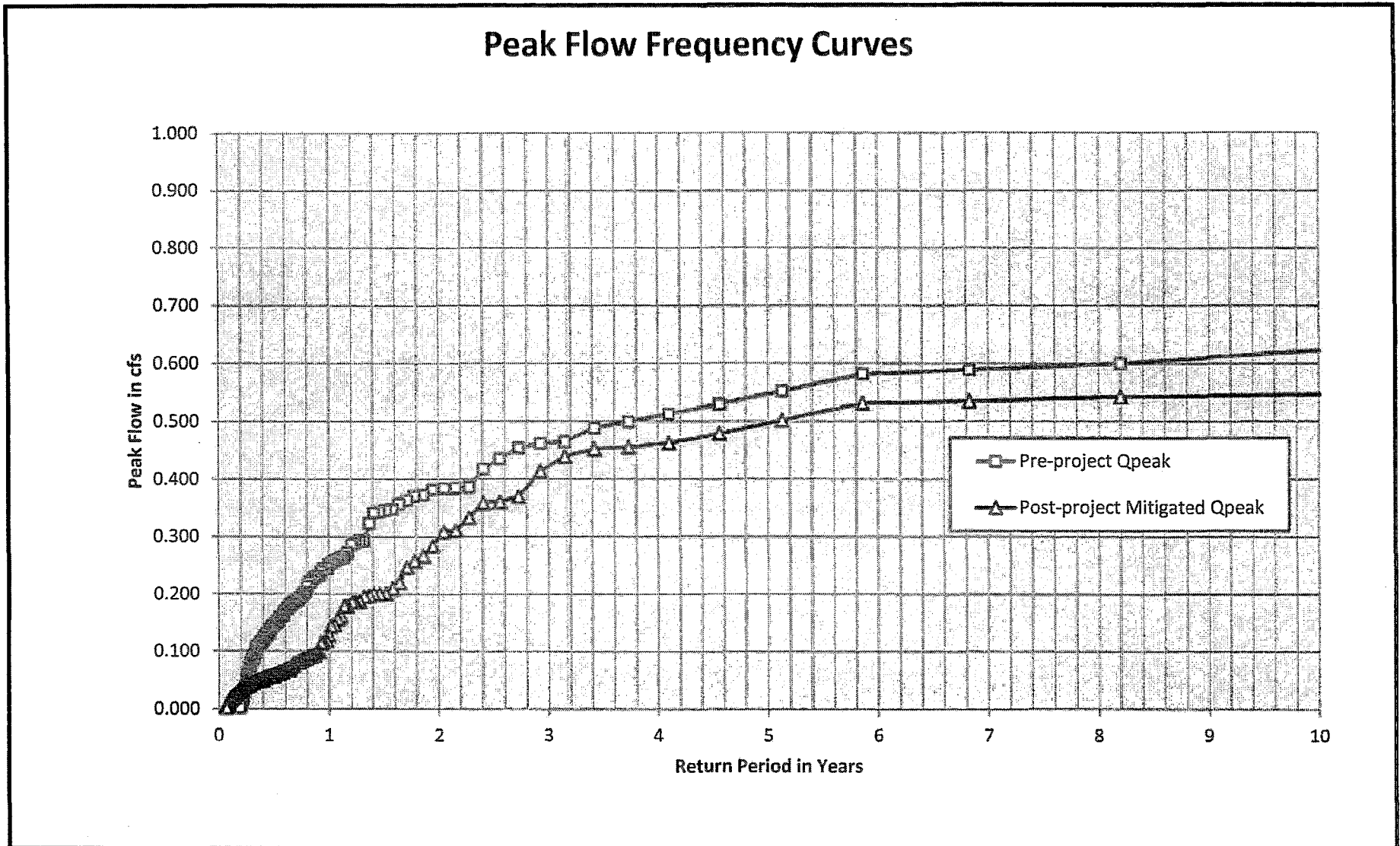
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602	3/25/1975	2	0.003	97.41	0.07					
603	11/12/2006	1	0.003	97.57	0.07					
604	2/21/1994	13	0.003	97.73	0.07					
605	10/17/2007	1	0.002	97.9	0.07					
606	2/5/1972	1	0.002	98.06	0.07					
607	1/10/1993	2	0.002	98.22	0.07					
608	2/11/2000	1	0.002	98.38	0.07					
609	4/23/2006	1	0.002	98.54	0.07					
610	11/1/1974	1	0.002	98.71	0.07					
611	3/22/1978	1	0.002	98.87	0.07					
613	3/7/1999	1	0.002	99.19	0.07					
613	3/22/1980	1	0.002	99.19	0.07					
614	3/8/2000	2	0.002	99.35	0.07					
615	1/28/1977	1	0.002	99.51	0.07					
616	12/12/1992	1	0.002	99.68	0.07					
617	12/10/1972	1	0.002	99.84	0.07					

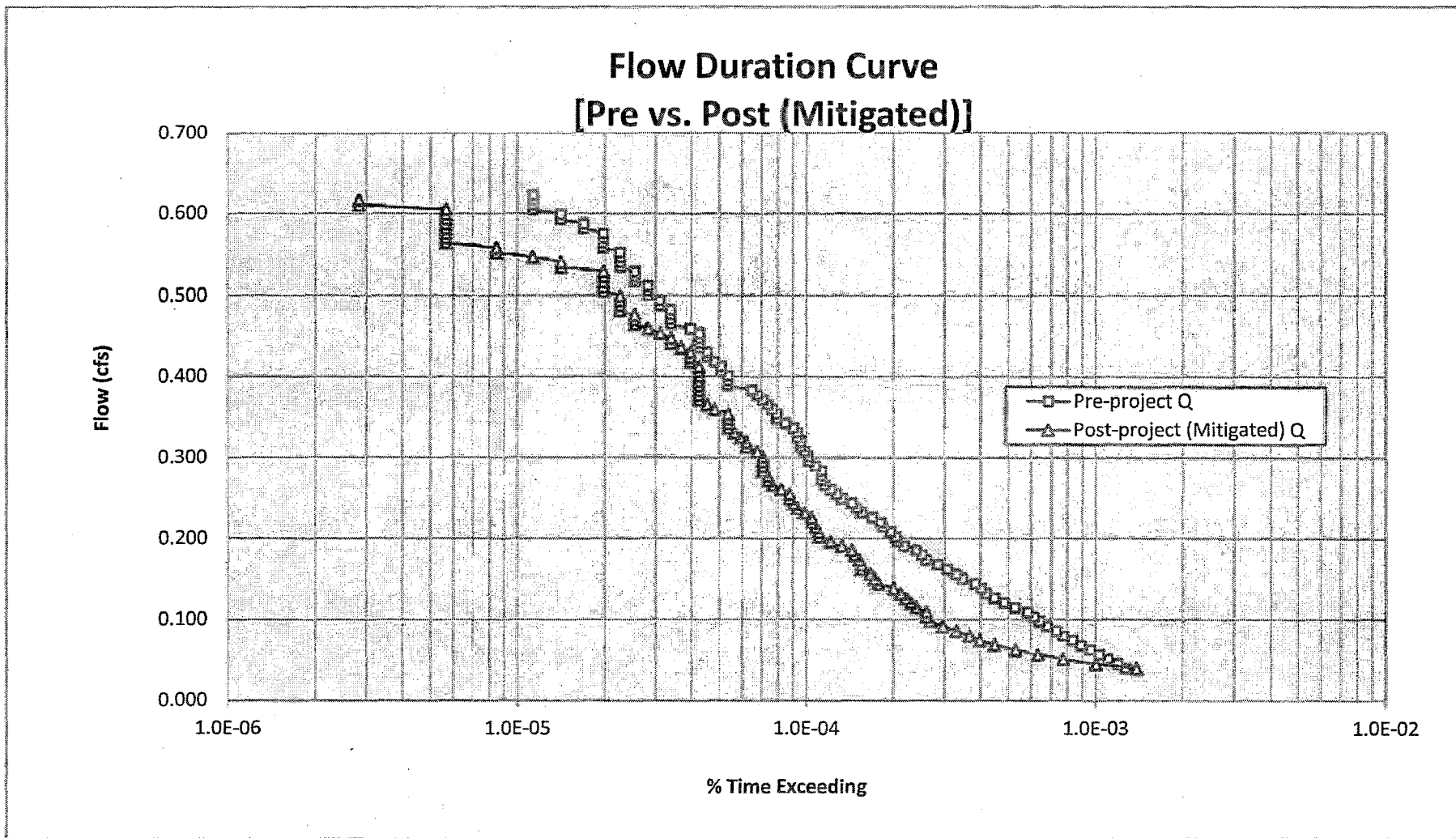
Output for Basin A

Peak Flow Frequency Summary

The Peak Flow Frequency is based on the 40 years of rainfall data from the Fashion Valley Rain Gage. The statistical analysis of the data is depicted on the previous sheets for pre and post project scenarios.

Return Period	Pre-project Qpeak (cfs)	Post-project - Mitigated Q (cfs)
LF = 0.1xQ2	0.040	0.029
2-year	0.396	0.293
5-year	0.546	0.494
10-year	0.623	0.547





Low-flow Threshold: 10%
 0.1xQ2 (Pre): 0.040 cfs
 Q10 (Pre): 0.623 cfs
 Ordinate #: 100
 Incremental Q (Pre): 0.00583 cfs
 Total Hourly Data: 353902 hours

The proposed BMP: PASSED

Interval	Pre-project Flow (cfs)	Pre-project Hours	Pre-project % Time Exceeding	Post-project Hours	Post-project % Time Exceeding	Percentage	Pass/Fail
0	0.040	449	1.27E-03	489	1.38E-03	109%	Pass
1	0.045	422	1.19E-03	355	1.00E-03	84%	Pass
2	0.051	391	1.10E-03	273	7.71E-04	70%	Pass
3	0.057	366	1.03E-03	224	6.33E-04	61%	Pass
4	0.063	341	9.64E-04	188	5.31E-04	55%	Pass
5	0.069	315	8.90E-04	159	4.49E-04	50%	Pass
6	0.075	295	8.34E-04	141	3.98E-04	48%	Pass
7	0.080	274	7.74E-04	130	3.67E-04	47%	Pass
8	0.086	259	7.32E-04	117	3.31E-04	45%	Pass
9	0.092	241	6.81E-04	105	2.97E-04	44%	Pass
10	0.098	227	6.41E-04	95	2.68E-04	42%	Pass
11	0.104	217	6.13E-04	92	2.60E-04	42%	Pass
12	0.110	206	5.82E-04	92	2.60E-04	45%	Pass
13	0.115	186	5.26E-04	85	2.40E-04	46%	Pass
14	0.121	171	4.83E-04	81	2.29E-04	47%	Pass
15	0.127	158	4.46E-04	78	2.20E-04	49%	Pass
16	0.133	148	4.18E-04	75	2.12E-04	51%	Pass
17	0.139	143	4.04E-04	71	2.01E-04	50%	Pass
18	0.145	136	3.84E-04	63	1.78E-04	46%	Pass
19	0.150	123	3.48E-04	61	1.72E-04	50%	Pass
20	0.156	117	3.31E-04	59	1.67E-04	50%	Pass
21	0.162	109	3.08E-04	55	1.55E-04	50%	Pass
22	0.168	101	2.85E-04	55	1.55E-04	54%	Pass
23	0.174	92	2.60E-04	54	1.53E-04	59%	Pass
24	0.180	89	2.51E-04	52	1.47E-04	58%	Pass
25	0.185	85	2.40E-04	51	1.44E-04	60%	Pass
26	0.191	77	2.18E-04	47	1.33E-04	61%	Pass

27	0.197	73	2.06E-04	43	1.22E-04	59%	Pass
28	0.203	72	2.03E-04	39	1.10E-04	54%	Pass
29	0.209	69	1.95E-04	39	1.10E-04	57%	Pass
30	0.215	65	1.84E-04	38	1.07E-04	58%	Pass
31	0.220	64	1.81E-04	37	1.05E-04	58%	Pass
32	0.226	60	1.70E-04	37	1.05E-04	62%	Pass
33	0.232	55	1.55E-04	35	9.89E-05	64%	Pass
34	0.238	53	1.50E-04	33	9.32E-05	62%	Pass
35	0.244	51	1.44E-04	32	9.04E-05	63%	Pass
36	0.250	47	1.33E-04	31	8.76E-05	66%	Pass
37	0.255	45	1.27E-04	31	8.76E-05	69%	Pass
38	0.261	43	1.22E-04	29	8.19E-05	67%	Pass
39	0.267	41	1.16E-04	27	7.63E-05	66%	Pass
40	0.273	40	1.13E-04	26	7.35E-05	65%	Pass
41	0.279	40	1.13E-04	26	7.35E-05	65%	Pass
42	0.285	40	1.13E-04	25	7.06E-05	63%	Pass
43	0.290	38	1.07E-04	25	7.06E-05	66%	Pass
44	0.296	36	1.02E-04	25	7.06E-05	69%	Pass
45	0.302	36	1.02E-04	25	7.06E-05	69%	Pass
46	0.308	35	9.89E-05	24	6.78E-05	69%	Pass
47	0.314	34	9.61E-05	22	6.22E-05	65%	Pass
48	0.320	34	9.61E-05	22	6.22E-05	65%	Pass
49	0.325	33	9.32E-05	21	5.93E-05	64%	Pass
50	0.331	33	9.32E-05	20	5.65E-05	61%	Pass
51	0.337	32	9.04E-05	19	5.37E-05	59%	Pass
52	0.343	30	8.48E-05	19	5.37E-05	63%	Pass
53	0.349	28	7.91E-05	19	5.37E-05	68%	Pass
54	0.355	28	7.91E-05	19	5.37E-05	68%	Pass
55	0.360	27	7.63E-05	17	4.80E-05	63%	Pass
56	0.366	26	7.35E-05	16	4.52E-05	62%	Pass
57	0.372	25	7.06E-05	15	4.24E-05	60%	Pass
58	0.378	24	6.78E-05	15	4.24E-05	63%	Pass
59	0.384	23	6.50E-05	15	4.24E-05	65%	Pass
60	0.390	19	5.37E-05	15	4.24E-05	79%	Pass
61	0.395	19	5.37E-05	15	4.24E-05	79%	Pass
62	0.401	19	5.37E-05	15	4.24E-05	79%	Pass
63	0.407	18	5.09E-05	15	4.24E-05	83%	Pass
64	0.413	18	5.09E-05	15	4.24E-05	83%	Pass
65	0.419	17	4.80E-05	14	3.96E-05	82%	Pass
66	0.425	16	4.52E-05	14	3.96E-05	88%	Pass
67	0.430	16	4.52E-05	14	3.96E-05	88%	Pass
68	0.436	15	4.24E-05	13	3.67E-05	87%	Pass

69	0.442	15	4.24E-05	12	3.39E-05	80%	Pass
70	0.448	15	4.24E-05	12	3.39E-05	80%	Pass
71	0.454	15	4.24E-05	11	3.11E-05	73%	Pass
72	0.460	14	3.96E-05	10	2.83E-05	71%	Pass
73	0.465	12	3.39E-05	9	2.54E-05	75%	Pass
74	0.471	12	3.39E-05	9	2.54E-05	75%	Pass
75	0.477	12	3.39E-05	9	2.54E-05	75%	Pass
76	0.483	12	3.39E-05	8	2.26E-05	67%	Pass
77	0.489	11	3.11E-05	8	2.26E-05	73%	Pass
78	0.495	11	3.11E-05	8	2.26E-05	73%	Pass
79	0.500	10	2.83E-05	8	2.26E-05	80%	Pass
80	0.506	10	2.83E-05	7	1.98E-05	70%	Pass
81	0.512	10	2.83E-05	7	1.98E-05	70%	Pass
82	0.518	9	2.54E-05	7	1.98E-05	78%	Pass
83	0.524	9	2.54E-05	7	1.98E-05	78%	Pass
84	0.530	9	2.54E-05	7	1.98E-05	78%	Pass
85	0.535	8	2.26E-05	5	1.41E-05	63%	Pass
86	0.541	8	2.26E-05	5	1.41E-05	63%	Pass
87	0.547	8	2.26E-05	4	1.13E-05	50%	Pass
88	0.553	8	2.26E-05	3	8.48E-06	38%	Pass
89	0.559	7	1.98E-05	3	8.48E-06	43%	Pass
90	0.565	7	1.98E-05	2	5.65E-06	29%	Pass
91	0.570	7	1.98E-05	2	5.65E-06	29%	Pass
92	0.576	7	1.98E-05	2	5.65E-06	29%	Pass
93	0.582	6	1.70E-05	2	5.65E-06	33%	Pass
94	0.588	6	1.70E-05	2	5.65E-06	33%	Pass
95	0.594	5	1.41E-05	2	5.65E-06	40%	Pass
96	0.600	5	1.41E-05	2	5.65E-06	40%	Pass
97	0.605	4	1.13E-05	2	5.65E-06	50%	Pass
98	0.611	4	1.13E-05	1	2.83E-06	25%	Pass
99	0.617	4	1.13E-05	1	2.83E-06	25%	Pass
100	0.623	4	1.13E-05	0	0.00E+00	0%	Pass

Drawdown Time Calculations- Basin A

Time = Volume/ Flowrate (out)

The flowrate out is determined by the orifice size, see Summary Table Below.

Summary Table of Draw Down Time for Biofiltration Areas Providing Hydromodification								
BMP NO.	ORIFICE DIA. (IN)	AREA (SF)	C	ORIFICE FLOW (CFS)	VOLUME OF PONDED WATER (V1 IN CF)	DRAW DOWN TIME (HOURS)	VOLUME TOTAL	DRAW DOWN TIME (HOURS)
1	0.4375	0.001044	0.67	0.011	550	13.91	3300	83.4

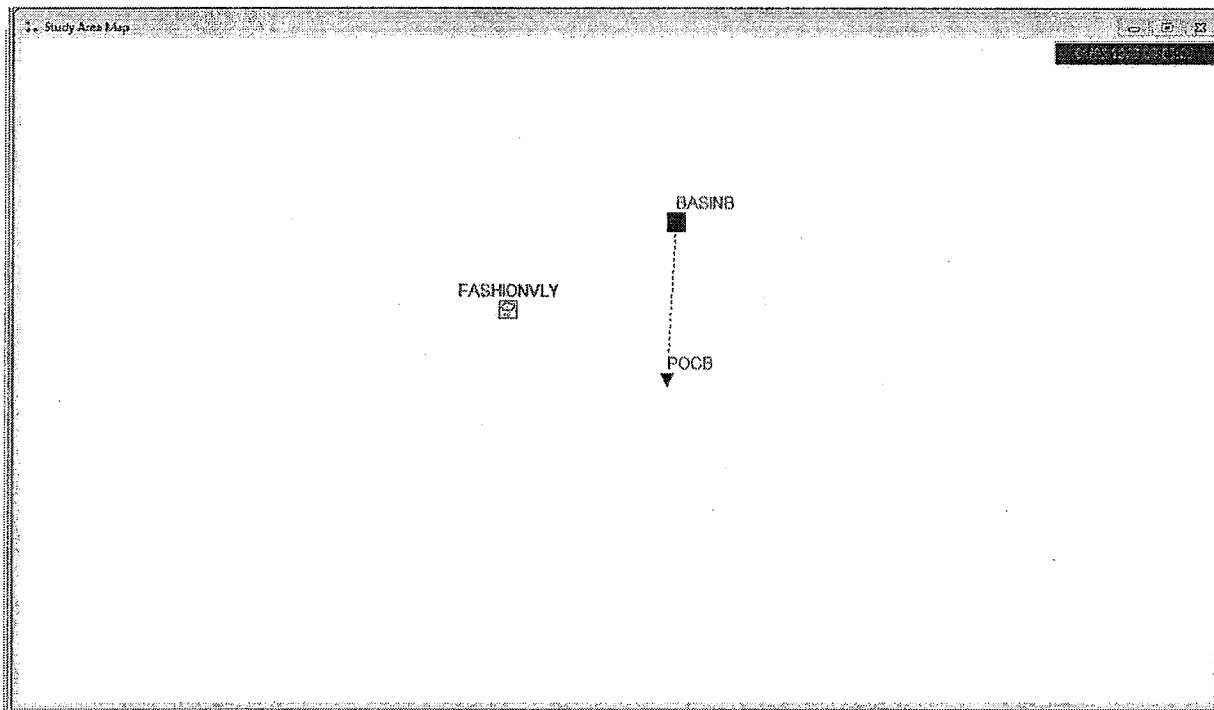
Basin B Subcatchment Input

According to the Redevelopment Rule (See Section 1.2.3) the structural BMP performance requirements and hydromodification management requirements apply only to the creation or replacement of impervious surface and not to the entire development.

Pre-developed Condition

See Exhibits U for the Pre-Developed Condition. The table below summarizes the subcatchment for the pre-developed conditions for Basin B.

Park De La Cruz Improvements					
SUBCATCHMENT INPUT FOR SWMM MODEL- PRE DEVELOPED CONDITIONS					
DRAINAGE AREA	DMA NAME	%IMPERVIOUS	SLOPE	AREA (SF)	Area (AC)
Pre-Developed B	BasinB	0	30.0%	34,020	0.781



Pre-project Flow Frequency - Long-term Simulation								
Park De La Cruz- Pre-Developed Conditions Basin B								
Statistics - Node PO CB Total Inflow								
Rank	Start Date	Event Duration (hours)	Event Peak (CFS)	Exceedance Frequency (percent)	Return Period (years)			
1	2/20/1980	3	0.678	0.46	41	10-year Q:	0.591	cfs
2	12/28/2004	20	0.608	0.92	20.5	5-year Q:	0.486	cfs
3	11/16/1972	21	0.594	1.38	13.67	2-year Q:	0.367	cfs
4	1/31/1979	15	0.592	1.83	10.25			
5	12/4/1987	1	0.586	2.29	8.2			
6	2/28/1970	2	0.553	2.75	6.83	Lower Flow Threshold:	10%	
7	3/11/1995	22	0.552	3.21	5.86			
8	1/25/1995	16	0.53	3.67	5.13	0.1xQ2 (Pre):	0.037	cfs
9	1/9/1978	14	0.483	4.13	4.56			
10	10/27/2004	20	0.48	4.59	4.1			
11	3/4/2005	6	0.469	5.05	3.73			
12	3/8/1968	2	0.457	5.5	3.42			
13	11/5/1987	2	0.454	5.96	3.15			
14	12/4/1974	1	0.437	6.42	2.93			
15	2/3/1998	7	0.43	6.88	2.73			
16	1/31/1993	1	0.42	7.34	2.56			
17	2/14/1998	10	0.402	7.8	2.41			
18	2/8/1998	9	0.386	8.26	2.28			
19	3/1/1983	66	0.372	8.72	2.16			
20	2/25/2003	7	0.358	9.17	2.05			
21	11/17/1984	2	0.357	9.63	1.95			
22	2/17/1998	8	0.354	10.09	1.86			
23	11/22/1984	15	0.351	10.55	1.78			
24	2/23/1998	7	0.346	11.01	1.71			
25	2/12/2003	27	0.343	11.47	1.64			
26	2/28/1981	20	0.341	11.93	1.58			
27	3/6/1975	2	0.337	12.39	1.52			
28	3/17/1982	19	0.329	12.84	1.46			
29	1/6/1979	3	0.329	13.3	1.41			
30	2/25/1981	1	0.318	13.76	1.37			

31	2/21/2005	9	0.311	14.22	1.32				
32	11/25/1983	3	0.292	14.68	1.28				
33	5/8/1977	9	0.291	15.14	1.24				
34	12/25/1988	3	0.283	15.6	1.21				
35	1/9/2005	6	0.282	16.06	1.17				
36	2/8/1976	8	0.279	16.51	1.14				
37	2/6/1969	3	0.278	16.97	1.11				
38	1/18/1993	16	0.275	17.43	1.08				
39	1/14/1969	8	0.275	17.89	1.05				
40	1/11/2001	34	0.271	18.35	1.02				
41	12/31/1976	2	0.267	18.81	1				
42	2/23/2000	2	0.257	19.27	0.98				
43	10/19/2004	26	0.255	19.72	0.95				
44	2/11/2005	15	0.253	20.18	0.93				
45	1/26/2001	1	0.247	20.64	0.91				
46	1/4/1995	6	0.246	21.1	0.89				
47	4/28/2005	1	0.245	21.56	0.87				
48	3/2/1992	8	0.245	22.02	0.85				
49	3/25/1998	2	0.236	22.48	0.84				
50	2/17/1971	2	0.236	22.94	0.82				
51	3/11/1978	12	0.233	23.39	0.8				
52	4/20/1988	26	0.231	23.85	0.79				
53	1/10/1995	46	0.224	24.31	0.77				
54	1/5/1977	33	0.212	24.77	0.76				
55	1/14/1978	15	0.203	25.23	0.75				
56	12/6/1997	3	0.202	25.69	0.73				
57	3/15/2003	26	0.199	26.15	0.72				
58	4/7/1999	2	0.199	26.61	0.71				
59	1/12/1993	2	0.197	27.06	0.69				
60	3/20/1973	1	0.196	27.52	0.68				
61	12/16/1987	4	0.195	27.98	0.67				
62	1/9/1998	25	0.194	28.44	0.66				
63	1/16/1978	4	0.194	28.9	0.65				
64	2/15/1992	5	0.19	29.36	0.64				
65	12/24/1971	5	0.187	29.82	0.63				
66	1/13/1993	2	0.186	30.28	0.62				
67	10/26/1991	2	0.185	30.73	0.61				
68	2/8/1993	3	0.184	31.19	0.6				
69	2/18/1993	23	0.183	31.65	0.59				
70	11/22/1996	5	0.182	32.11	0.59				
71	3/23/1992	1	0.177	32.57	0.58				
72	1/4/1987	3	0.17	33.03	0.57				

73	3/19/1981	1	0.169	33.49	0.56				
74	11/23/1973	4	0.169	33.94	0.55				
75	11/29/1970	10	0.166	34.4	0.55				
76	2/19/2007	2	0.166	34.86	0.54				
77	2/7/1983	4	0.165	35.32	0.53				
78	3/5/1981	9	0.164	35.78	0.53				
79	2/6/1992	6	0.162	36.24	0.52				
80	1/11/2005	8	0.161	36.7	0.51				
81	1/23/2008	2	0.158	37.16	0.51				
82	2/22/2005	9	0.158	37.61	0.5				
83	2/21/2000	17	0.158	38.07	0.49				
84	12/25/2003	1	0.157	38.53	0.49				
85	2/12/1992	11	0.154	38.99	0.48				
86	3/19/1991	56	0.153	39.45	0.48				
87	11/10/1982	1	0.152	39.91	0.47				
88	3/17/1979	4	0.151	40.37	0.47				
89	3/10/1980	5	0.15	40.83	0.46				
90	2/2/1983	17	0.149	41.28	0.46				
91	3/22/2005	2	0.148	41.74	0.45				
92	11/25/1988	2	0.147	42.2	0.45				
93	1/29/1980	22	0.147	42.66	0.44				
94	8/17/1977	4	0.146	43.12	0.44				
95	2/22/2004	12	0.146	43.58	0.43				
96	1/15/1993	26	0.145	44.04	0.43				
97	4/12/1999	3	0.145	44.5	0.42				
98	12/19/1970	4	0.145	44.95	0.42				
99	3/11/2006	1	0.145	45.41	0.41				
100	2/11/1973	2	0.143	45.87	0.41				
101	3/20/1979	19	0.141	46.33	0.41				
102	1/7/2005	3	0.141	46.79	0.4				
103	12/21/1970	2	0.141	47.25	0.4				
104	2/14/1995	2	0.141	47.71	0.39				
105	11/11/1972	2	0.141	48.17	0.39				
106	4/8/1975	24	0.139	48.62	0.39				
107	2/10/1976	7	0.139	49.08	0.38				
108	2/12/1978	4	0.138	49.54	0.38				
109	1/17/1990	2	0.138	50	0.38				
110	3/6/1980	6	0.136	50.46	0.37				
111	2/10/1982	1	0.134	50.92	0.37				
112	4/18/1995	1	0.134	51.38	0.37				
113	3/4/1970	3	0.133	51.83	0.36				
114	12/29/1991	2	0.133	52.29	0.36				

115	3/18/1983	2	0.13	52.75	0.36				
116	1/25/1969	3	0.13	53.21	0.35				
117	4/1/1982	3	0.128	53.67	0.35				
118	1/29/1981	2	0.127	54.13	0.35				
119	1/3/2005	24	0.127	54.59	0.34				
120	1/12/1997	1	0.125	55.05	0.34				
121	10/30/1996	2	0.125	55.5	0.34				
122	1/4/1974	1	0.123	55.96	0.34				
123	1/6/1993	34	0.122	56.42	0.33				
124	3/11/1973	8	0.121	56.88	0.33				
125	3/4/1978	14	0.12	57.34	0.33				
126	4/14/2003	1	0.118	57.8	0.33				
127	11/24/1984	7	0.112	58.26	0.32				
128	12/29/1982	1	0.111	58.72	0.32				
129	12/27/1971	23	0.109	59.17	0.32				
130	11/28/1981	21	0.108	59.63	0.32				
131	3/24/1983	3	0.106	60.09	0.31				
132	2/26/2004	17	0.105	60.55	0.31				
133	11/13/1978	1	0.105	61.01	0.31				
134	2/15/1986	9	0.104	61.47	0.31				
135	12/7/1992	4	0.102	61.93	0.3				
136	12/21/1988	1	0.095	62.39	0.3				
137	3/28/1998	2	0.093	62.84	0.3				
138	2/22/2008	1	0.092	63.3	0.3				
139	1/14/1990	3	0.09	63.76	0.29				
140	1/25/1997	8	0.09	64.22	0.29				
141	3/5/1995	1	0.09	64.68	0.29				
142	3/14/1982	7	0.089	65.14	0.29				
143	2/6/1976	2	0.089	65.6	0.29				
144	3/15/1986	10	0.088	66.06	0.28				
145	3/5/2000	2	0.088	66.51	0.28				
146	3/8/1975	3	0.085	66.97	0.28				
147	1/7/2008	1	0.084	67.43	0.28				
148	12/11/1984	5	0.082	67.89	0.28				
149	5/1/1980	2	0.082	68.35	0.28				
150	3/25/1991	44	0.082	68.81	0.27				
151	2/22/1969	7	0.081	69.27	0.27				
152	1/27/1983	3	0.08	69.72	0.27				
153	10/29/2000	2	0.078	70.18	0.27				
154	2/16/1980	2	0.078	70.64	0.27				
155	12/21/2002	2	0.076	71.1	0.26				
156	3/10/1975	28	0.075	71.56	0.26				

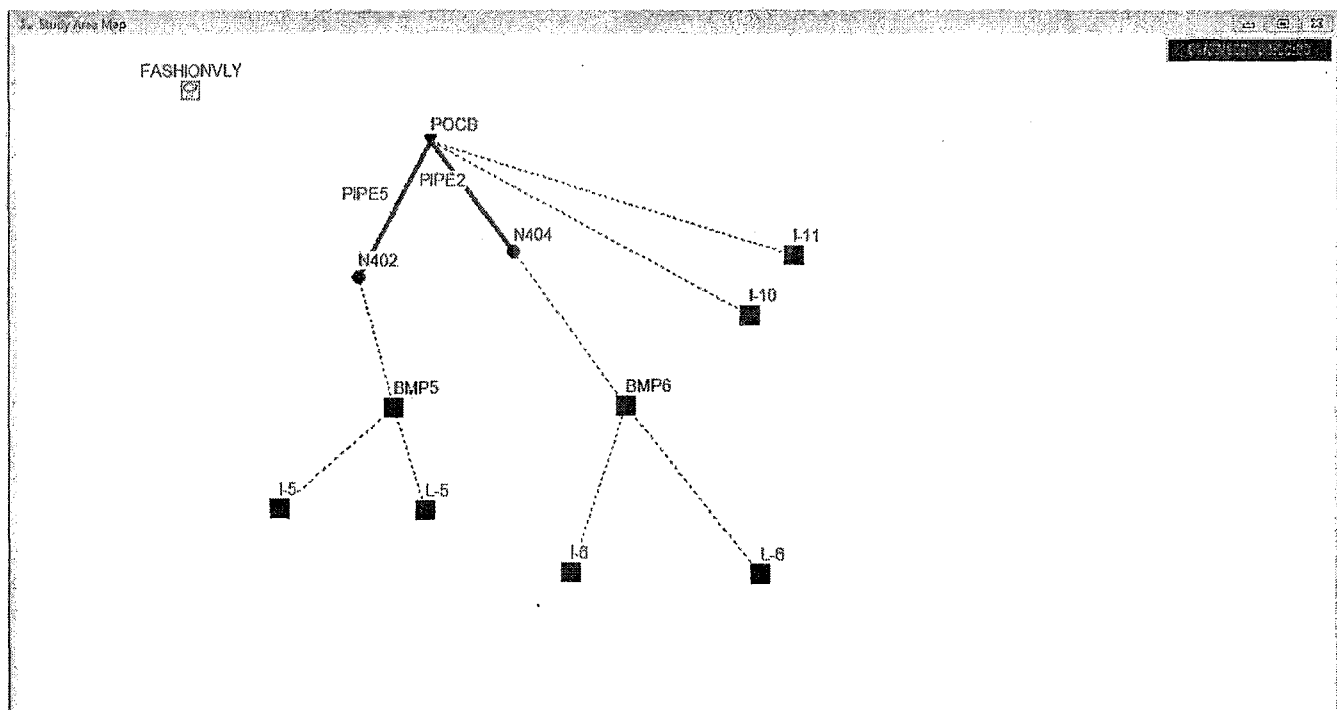
157	1/5/2008	1	0.072	72.02	0.26				
158	2/27/1983	16	0.071	72.48	0.26				
159	2/19/1969	6	0.071	72.94	0.26				
160	1/7/1974	13	0.07	73.39	0.26				
161	11/24/1978	5	0.069	73.85	0.25				
162	1/15/1998	2	0.069	74.31	0.25				
163	4/7/1978	2	0.068	74.77	0.25				
164	3/21/1983	1	0.065	75.23	0.25				
165	12/4/1972	2	0.064	75.69	0.25				
166	1/26/1999	11	0.064	76.15	0.25				
167	1/23/1997	2	0.063	76.61	0.25				
168	2/18/1980	6	0.062	77.06	0.24				
169	2/7/1976	2	0.06	77.52	0.24				
170	1/29/1983	4	0.059	77.98	0.24				
171	3/8/1974	8	0.054	78.44	0.24				
172	1/26/1969	2	0.054	78.9	0.24				
173	3/2/1970	1	0.052	79.36	0.24				
174	1/9/1980	2	0.052	79.82	0.24				
175	12/29/1992	1	0.051	80.28	0.23				
176	3/10/1978	3	0.049	80.73	0.23				
177	2/25/1969	4	0.047	81.19	0.23				
178	2/13/1973	1	0.046	81.65	0.23				
179	2/9/1981	1	0.046	82.11	0.23				
180	1/27/2008	8	0.042	82.57	0.23				
181	2/7/1994	17	0.04	83.03	0.23				
182	1/15/1979	2	0.04	83.49	0.23				
183	12/31/2004	2	0.039	83.94	0.22				
184	4/20/1983	2	0.036	84.4	0.22				
185	1/12/1980	2	0.036	84.86	0.22				
186	11/30/2007	1	0.035	85.32	0.22				
187	6/5/1993	1	0.034	85.78	0.22				
188	12/21/1997	2	0.034	86.24	0.22				
189	2/9/1992	3	0.033	86.7	0.22				
190	1/16/1970	2	0.032	87.16	0.22				
191	10/16/1971	1	0.029	87.61	0.21				
192	2/23/1993	3	0.026	88.07	0.21				
193	2/18/2005	2	0.026	88.53	0.21				
194	2/7/1978	1	0.026	88.99	0.21				
195	11/11/1985	6	0.025	89.45	0.21				
196	12/27/1984	6	0.024	89.91	0.21				
197	3/28/1979	6	0.023	90.37	0.21				
198	2/25/1987	1	0.023	90.83	0.21				

199	1/21/1969	1	0.021	91.28	0.21				
200	1/31/1996	5	0.021	91.74	0.2				
201	12/29/1977	1	0.02	92.2	0.2				
202	3/26/1980	1	0.019	92.66	0.2				
203	1/1/1982	1	0.018	93.12	0.2				
204	4/13/1976	3	0.017	93.58	0.2				
205	2/10/1978	1	0.016	94.04	0.2				
206	11/26/1973	2	0.016	94.5	0.2				
207	1/8/1995	1	0.015	94.95	0.2				
208	3/1/1978	5	0.015	95.41	0.2				
209	11/21/1978	1	0.015	95.87	0.2				
210	1/29/1998	1	0.012	96.33	0.2				
211	12/4/1971	1	0.011	96.79	0.19				
212	3/31/1978	2	0.01	97.25	0.19				
213	12/17/1978	24	0.007	97.71	0.19				
214	1/17/1988	1	0.005	98.17	0.19				
215	2/27/1991	1	0.004	98.62	0.19				
216	3/25/1989	1	0.004	99.08	0.19				
217	3/1/1979	2	0.002	99.54	0.19				

Basin B Proposed Condition

See Exhibit J for the proposed condition & BMP details. The table below summarizes the subcatchments for the proposed conditions for Basin B.

Park De La Cruz Improvements					
SUBCATCHMENT INPUT FOR Basin B- SWMM MODEL- PROPOSED CONDITIONS					
DRAINAGE AREA	DMA NAME	%IMPERVIOUS	SLOPE	AREA (SF)	Area (AC)
B1	I-6	100	1.5%	6520	0.150
	L-6	0	2.0%	17390	0.399
B2	I-7	100	1.0%	3920	0.090
	L-7	0	2.0%	2470	0.057
I-10	I-10	100	1.0%	2890	0.066
I-11	I-11	100	1.0%	830	0.019
BMP 5	BMP 5	0	0.0%	420	0.010
BMP 6	BMP 6	0	0.0%	170	0.004
Total					0.781



LID Input- Basin B

Park De La Cruz- Biofiltration Parameters Summary					
BMP #	BMP AREA (SF) PROVIDED	PONDING DEPTH (FT)	V1 (CF)	SOIL DEPTH (FT)	GRAVEL DEPTH (FT)
5	420	0.50	210	2.5	1
6	170	0.50	85	2.5	1

Bmp #5- SWMM INPUT

LID Control Editor

Control Name: BMP5

LID Type: Bio-Retention Cell

*Optional

OK Cancel Help

Surface	Soil	Storage	Drain
Berm Height (in. or mm)		6	
Vegetation Volume Fraction		0.0	
Surface Roughness (Mannings n)		0	
Surface Slope (percent)		2	

LID Control Editor

Control Name: BMP5

LID Type: Bio-Retention Cell

*Optional

Surface	Soil	Storage	Drain
Thickness (in. or mm)		30	
Porosity (volume fraction)		0.40	
Field Capacity (volume fraction)		0.2	
Wilting Point (volume fraction)		0.1	
Conductivity (in/hr or mm/hr)		5	
Conductivity Slope		5	
Suction Head (in. or mm)		1.5	

OK Cancel Help

LID Control Editor

Control Name: BMP5

LID Type: Bio-Retention Cell

*Optional

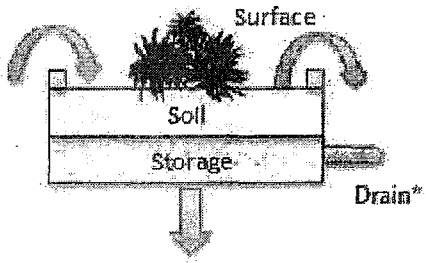
Surface	Soil	Storage	Drain
Thickness (in. or mm)		12	
Void Ratio (Voids / Solids)		.67	
Seepage Rate (in/hr or mm/hr)		0	
Clogging Factor		0	

OK Cancel Help

LID Control Editor

Control Name: BMP5

LID Type: Bio-Retention Cell



*Optional

OK Cancel Help

Surface	Soil	Storage	Drain
Flow Coefficient*		.3731	
Flow Exponent		0.5	
Offset Height (in. or mm)		0	
Drain Advisor			

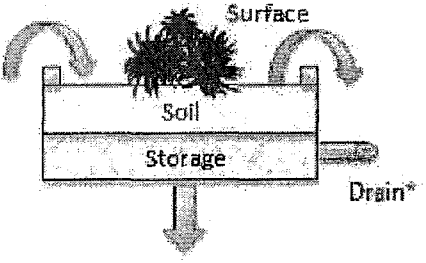
*Units are for flow in either in/hr or mm/hr; use 0 if there is no drain.

Bmp #6- SWMM INPUT

LID Control Editor

Control Name: BMP6

LID Type: Bio-Retention Cell



*Optional

OK Cancel Help

Surface	Soil	Storage	Drain
Berm Height (in. or mm)		6	
Vegetation Volume Fraction		0.0	
Surface Roughness (Mannings n)		0.0	
Surface Slope (percent)		0.0	

LID Control Editor

Control Name: BMP6

LID Type: Bio-Retention Cell

*Optional

Surface	Soil	Storage	Drain
Thickness (in. or mm)		30	
Porosity (volume fraction)		0.40	
Field Capacity (volume fraction)		0.2	
Wilting Point (volume fraction)		0.1	
Conductivity (in/hr or mm/hr)		5	
Conductivity Slope		5	
Suction Head (in. or mm)		1.5	

OK Cancel Help

LID Control Editor

Control Name: BMP6

LID Type: Bio-Retention Cell

*Optional

Surface	Soil	Storage	Drain
Thickness (in. or mm)		12	
Void Ratio (Voids / Solids)		0.67	
Seepage Rate (in/hr or mm/hr)		0	
Clogging Factor		0	

OK Cancel Help

LID Control Editor

Control Name: BMP6

LID Type: Bio-Retention Cell

Surface	Soil	Storage	Drain
Flow Coefficient*		0.5341	
Flow Exponent		0.5	
Offset Height (in. or mm)		6	
Drain Advisor			

*Optional

OK Cancel Help

*Units are for flow in either in/hr or mm/hr; use 0 if there is no drain.

**SWMM Model Flow Coefficient Calculation-
 BMP #5**

PARAMETER	ABBREV.	Bio-Retention Cell LID BMP	
Ponding Depth	PD	6	in
Bioretention Soil Layer	S	30	in
Gravel Layer	G	12	in
TOTAL		4.0	ft
		48	in
Orifice Coefficient	c_g	0.6	--
Low Flow Orifice Diameter	D	0.4375	in
Drain exponent	n	0.5	--
Flow Rate (volumetric)	Q	0.010	cfs
Ponding Depth Surface Area	A_{PD}	420	ft ²
Bioretention Surface Area	A_S, A_G	420	ft ²
	A_S, A_G	0.0096	ac
Porosity of Bioretention Soil	n	0.40	-
Flow Rate (per unit area)	q	2.579	in/hr
Effective Ponding Depth	PD_{eff}	6.00	in
Flow Coefficient	C	0.3731	--

SWMM Model Flow Coefficient Calculation-
BMP #6

PARAMETER	ABBREV.	Bio-Retention Cell LID BMP	
Ponding Depth	PD	6	in
Bioretention Soil Layer	S	30	in
Gravel Layer	G	12	in
TOTAL		4.0	ft
		48	in
Orifice Coefficient	c_g	0.6	--
Low Flow Orifice Diameter	D	0.333	in
Drain exponent	n	0.5	--
Flow Rate (volumetric)	Q	0.006	cfs
Ponding Depth Surface Area	A_{PD}	170	ft ²
Bioretention Surface Area	A_S, A_G	170	ft ²
	A_S, A_G	0.0039	ac
Porosity of Bioretention Soil	n	0.40	-
Flow Rate (per unit area)	q	3.694	in/hr
Effective Ponding Depth	PD_{eff}	6.00	in
Flow Coefficient	C	0.5341	--

Orifice Size and Flow Coefficient

BMP5 &6

0.10Q2 = 0.037 cfs, this was an interpolation of the time-series analysis for the pre-developed conditions. See SWMM results summary.

Orifice Equation:

$$Q = C * A * (2gd)^{0.5}$$
$$A = \frac{Q}{C * (2gd)^{0.5}}$$

$$r = \sqrt{A/\pi}$$

$$C = 0.67$$

$$g = 32.2$$

d = head of water over orifice, 3.33'

A = area of orifice

The maximum orifice size for this lower flow threshold will be 0.83 in. However, since some impervious surface is bypassing the BMP, a trial and error process yields an orifice size of 7/16" diameter for BMP #5 and 1/3" diameter for BMP #6 in order to meet the flow performance criteria depicted in the previous section.

Determining the Flow Coefficient

See the Formulas in BMP 1 Calculations

BMP #5

So, for 0.4375" diameter orifice, the $A = (0.4375/2/12)^2 * \pi = 0.00104$ sf, $Q_{\text{orifice}} = 0.011$ cfs

The Unit Flow Rate, $q = 0.011$ cfs/(0.40*420sf) = 0.0000655f/s*3600*12 = 2.53 in/hr

Then the flow coefficient = 2.53 in/hr/(46in)^{0.5} = 0.37

BMP #6

So, for 0.333" diameter orifice, the $A = (0.33/2/12)^2 * \pi = 0.000594$ sf, $Q_{\text{orifice}} = 0.006$ cfs

The Unit Flow Rate, $q = 0.006$ cfs/(0.40*170sf) = 0.0000882f/s*3600*12 = 3.62 in/hr

Then the flow coefficient = 2.62 in/hr/(46in)^{0.5} = 0.53

Flow Control Performance Criteria:

a. For flow rates ranging from 10 percent of the pre-project 2-year run-off event to the pre-project 10 year run-off event, the post project discharge rates and durations shall not deviate above the pre-project rates and durations by more than 10 percent over and more than 10 percent of the length of the flow duration curve.

b. For flow rates ranging from the lower flow threshold to the 5-year runoff event, the post-project peak flows shall not exceed pre-project peak flows. For flow rates from Q5 to Q10, post project peak flows may exceed pre-project flows by up to 10 percent for a 1-year frequency interval.

Determining the Flow Coefficient

Based on the SWMM manual the flow coefficient is based on the following formula:

$$q = C(h - H_d)^n$$

Where q = Unit Flow Rate (ft/s)

C = Flow coefficient

h = Pressure head acting on orifice (ft)

H_d = Drain Offset Height (ft)

n = Power Law Coefficient ($n=0.5$ to act like an orifice).

The unit flow rate $q = Q_{\text{orifice}} / (\eta A_{\text{lid}})$

Where Q_{orifice} = Volumetric Outflow Rate (cfs)

η = Engineered Soil Porosity

A_{lid} = Surface Area of LID

As mentioned above the Orifice Equation =

$$Q_{\text{orifice}} = C_o * A (2gd)^{0.5}$$

Where $r = \sqrt{A/\pi}$

$C_o = 0.67$

$g = 32.2$

d = head of water over orifice

A = area of orifice

**Post-project (Mitigated) Flow Frequency -
 Long-term Simulation**

Park De La Cruz- Proposed Condition Drainage Basin B NW Parking Lot								
Statistics - Node POCB Total Inflow								
		Event	Event	Exceedance	Return			
		Duration	Peak	Frequency	Period			
Rank	Start Date	(hours)	(CFS)	(percent)	(years)			
1	2/13/1980	196	0.582	0.17	41		10-year Q:	0.456 cfs
2	1/31/1979	70	0.533	0.34	20.5		5-year Q:	0.466 cfs
3	12/28/2004	38	0.48	0.51	13.67		2-year Q:	0.281 cfs
4	3/4/2005	22	0.456	0.68	10.25			
5	3/11/1995	33	0.454	0.85	8.2			
6	2/28/1970	44	0.445	1.02	6.83		Lower Flow Threshold:	10%
7	10/27/2004	37	0.442	1.19	5.86			
8	11/16/1972	33	0.437	1.36	5.13		0.1xQ2 (Post Mit):	0.028 cfs
9	12/4/1987	14	0.429	1.53	4.56			
10	3/8/1968	16	0.39	1.69	4.1			
11	1/23/1995	60	0.386	1.86	3.73			
12	2/3/1998	37	0.364	2.03	3.42			
13	12/4/1974	18	0.357	2.2	3.15			
14	2/14/1998	39	0.329	2.37	2.93			
15	1/5/1979	35	0.318	2.54	2.73			
16	2/21/2005	62	0.316	2.71	2.56			
17	2/6/1998	78	0.306	2.88	2.41			
18	1/9/1978	35	0.304	3.05	2.28			
19	2/28/1981	42	0.28	3.22	2.16			
20	1/14/1969	26	0.278	3.39	2.05			
21	11/4/1987	39	0.276	3.56	1.95			
22	2/17/1998	29	0.262	3.73	1.86			
23	2/25/2003	26	0.256	3.9	1.78			
24	1/3/1995	53	0.248	4.07	1.71			
25	2/22/1998	55	0.241	4.24	1.64			
26	1/10/1995	59	0.224	4.41	1.58			
27	2/11/2003	83	0.222	4.58	1.52			
28	1/14/1978	27	0.213	4.75	1.46			
29	3/5/1975	30	0.209	4.92	1.41			
30	3/17/1982	40	0.194	5.08	1.37			

31	2/27/1983	133	0.176	5.25	1.32				
32	2/3/1976	176	0.169	5.42	1.28				
33	3/9/1978	72	0.166	5.59	1.24				
34	2/20/2000	51	0.149	5.76	1.21				
35	1/7/2005	107	0.138	5.93	1.17				
36	1/4/1987	23	0.132	6.1	1.14				
37	1/12/1993	155	0.131	6.27	1.11				
38	10/19/2004	50	0.126	6.44	1.08				
39	3/5/1981	24	0.124	6.61	1.05				
40	1/31/1993	14	0.122	6.78	1.02				
41	12/16/1987	26	0.117	6.95	1				
42	2/2/1983	25	0.111	7.12	0.98				
43	1/4/1977	64	0.11	7.29	0.95				
44	1/16/1978	17	0.106	7.46	0.93				
45	4/20/1988	57	0.099	7.63	0.91				
46	2/23/2000	15	0.098	7.8	0.89				
47	3/10/1980	18	0.092	7.97	0.87				
48	2/7/1993	32	0.088	8.14	0.85				
49	12/19/1970	68	0.074	8.31	0.84				
50	2/25/1981	16	0.074	8.47	0.82				
51	11/21/1996	25	0.072	8.64	0.8				
52	2/15/1992	18	0.069	8.81	0.79				
53	11/21/1984	51	0.066	8.98	0.77				
54	2/18/1993	53	0.063	9.15	0.76				
55	5/8/1977	23	0.062	9.32	0.75				
56	3/2/1992	27	0.062	9.49	0.73				
57	12/24/1971	41	0.061	9.66	0.72				
58	11/28/1970	39	0.056	9.83	0.71				
59	11/16/1984	18	0.054	10	0.69				
60	1/11/2001	50	0.053	10.17	0.68				
61	2/13/1995	32	0.053	10.34	0.67				
62	1/28/1980	62	0.052	10.51	0.66				
63	8/16/1977	27	0.051	10.68	0.65				
64	1/3/2005	37	0.05	10.85	0.64				
65	2/6/1983	59	0.05	11.02	0.63				
66	2/6/1992	25	0.048	11.19	0.62				
67	3/18/1991	66	0.047	11.36	0.61				
68	2/6/1969	17	0.045	11.53	0.6				
69	12/7/1992	20	0.045	11.69	0.59				
70	1/25/1997	37	0.044	11.86	0.59				
71	2/26/2004	31	0.044	12.03	0.58				
72	12/10/1984	28	0.044	12.2	0.57				

73	2/15/1986	30	0.044	12.37	0.56					
74	12/24/1988	32	0.044	12.54	0.55					
75	3/25/1998	35	0.044	12.71	0.55					
76	2/19/2007	20	0.043	12.88	0.54					
77	3/15/1986	35	0.043	13.05	0.53					
78	3/25/1991	51	0.043	13.22	0.53					
79	1/6/1993	71	0.043	13.39	0.52					
80	11/24/1984	17	0.042	13.56	0.51					
81	11/25/1983	14	0.042	13.73	0.51					
82	1/13/1990	52	0.041	13.9	0.5					
83	3/7/1974	19	0.041	14.07	0.49					
84	1/4/1974	109	0.04	14.24	0.49					
85	1/5/2008	57	0.04	14.41	0.48					
86	2/12/1992	37	0.039	14.58	0.48					
87	11/28/1981	33	0.039	14.75	0.47					
88	4/11/1999	19	0.039	14.92	0.47					
89	2/16/1971	22	0.039	15.08	0.46					
90	1/27/1983	14	0.039	15.25	0.46					
91	3/17/1979	15	0.039	15.42	0.45					
92	2/11/2005	41	0.039	15.59	0.45					
93	12/6/1997	36	0.038	15.76	0.44					
94	1/23/1997	22	0.038	15.93	0.44					
95	10/30/1996	14	0.038	16.1	0.43					
96	10/26/1991	13	0.038	16.27	0.43					
97	3/15/2003	38	0.038	16.44	0.42					
98	3/4/1978	36	0.038	16.61	0.42					
99	12/30/1976	32	0.037	16.78	0.41					
100	12/27/1971	33	0.037	16.95	0.41					
101	1/9/1998	42	0.037	17.12	0.41					
102	11/25/1988	15	0.037	17.29	0.4					
103	1/26/2001	19	0.037	17.46	0.4					
104	4/8/1975	31	0.037	17.63	0.39					
105	2/22/1969	55	0.037	17.8	0.39					
106	11/23/1973	13	0.037	17.97	0.39					
107	12/4/1972	15	0.036	18.14	0.38					
108	3/4/1970	15	0.036	18.31	0.38					
109	3/22/2005	15	0.036	18.47	0.38					
110	4/6/1999	24	0.036	18.64	0.37					
111	1/23/2008	14	0.036	18.81	0.37					
112	3/20/1973	12	0.036	18.98	0.37					
113	2/22/2004	32	0.035	19.15	0.36					
114	3/14/1982	21	0.035	19.32	0.36					

115	1/12/1997	20	0.034	19.49	0.36					
116	3/19/1981	12	0.034	19.66	0.35					
117	3/6/1980	17	0.034	19.83	0.35					
118	2/12/1978	18	0.034	20	0.35					
119	4/28/2005	11	0.034	20.17	0.34					
120	2/18/1969	53	0.034	20.34	0.34					
121	1/24/1969	75	0.034	20.51	0.34					
122	2/27/1991	48	0.033	20.68	0.34					
123	4/18/1995	12	0.033	20.85	0.33					
124	12/29/1991	18	0.033	21.02	0.33					
125	2/22/2008	13	0.032	21.19	0.33					
126	3/5/1995	29	0.032	21.36	0.33					
127	12/29/1982	11	0.032	21.53	0.32					
128	11/11/1985	35	0.032	21.69	0.32					
129	4/1/1982	12	0.032	21.86	0.32					
130	4/14/2003	15	0.032	22.03	0.32					
131	1/28/1981	66	0.031	22.2	0.31					
132	11/10/1972	21	0.031	22.37	0.31					
133	2/11/1973	51	0.03	22.54	0.31					
134	11/9/1982	36	0.03	22.71	0.31					
135	5/1/1980	12	0.029	22.88	0.3					
136	3/5/2000	21	0.029	23.05	0.3					
137	1/16/1990	17	0.029	23.22	0.3					
138	10/29/2000	12	0.029	23.39	0.3					
139	4/13/1976	13	0.028	23.56	0.29					
140	1/9/1980	87	0.028	23.73	0.29					
141	3/11/1973	16	0.028	23.9	0.29					
142	3/31/1978	54	0.028	24.07	0.29					
143	2/17/1994	54	0.028	24.24	0.29					
144	2/8/1981	15	0.028	24.41	0.28					
145	2/9/1982	35	0.028	24.58	0.28					
146	3/23/1992	10	0.028	24.75	0.28					
147	3/22/1983	45	0.027	24.92	0.28					
148	3/21/1995	12	0.026	25.08	0.28					
149	12/30/1981	79	0.026	25.25	0.28					
150	3/24/1994	28	0.026	25.42	0.27					
151	2/18/2005	31	0.026	25.59	0.27					
152	6/5/1993	11	0.026	25.76	0.27					
153	3/25/1989	22	0.025	25.93	0.27					
154	2/9/1992	11	0.025	26.1	0.27					
155	11/12/1976	11	0.025	26.27	0.26					
156	12/25/2003	28	0.025	26.44	0.26					

157	12/31/2004	10	0.025	26.61	0.26				
158	3/19/1979	60	0.025	26.78	0.26				
159	3/1/1976	41	0.025	26.95	0.26				
160	3/10/1975	39	0.025	27.12	0.26				
161	2/25/1969	18	0.025	27.29	0.25				
162	1/17/1988	17	0.025	27.46	0.25				
163	2/23/1993	16	0.024	27.63	0.25				
164	11/25/1970	15	0.024	27.8	0.25				
165	12/17/1978	60	0.024	27.97	0.25				
166	3/8/1975	16	0.024	28.14	0.25				
167	1/26/2008	21	0.024	28.31	0.25				
168	11/30/2007	23	0.024	28.47	0.24				
169	11/13/1978	15	0.023	28.64	0.24				
170	3/25/1993	24	0.023	28.81	0.24				
171	2/27/1978	75	0.023	28.98	0.24				
172	4/14/1988	11	0.023	29.15	0.24				
173	3/17/1983	53	0.023	29.32	0.24				
174	12/3/1971	31	0.023	29.49	0.24				
175	2/10/1970	26	0.023	29.66	0.23				
176	12/21/1988	9	0.023	29.83	0.23				
177	2/27/2006	21	0.023	30	0.23				
178	1/16/1973	10	0.022	30.17	0.23				
179	12/27/1984	32	0.022	30.34	0.23				
180	2/17/1990	32	0.022	30.51	0.23				
181	11/17/1986	21	0.022	30.68	0.23				
182	1/15/1979	12	0.022	30.85	0.23				
183	3/1/1979	14	0.022	31.02	0.22				
184	3/11/2006	12	0.022	31.19	0.22				
185	10/16/1971	43	0.022	31.36	0.22				
186	2/2/1988	22	0.022	31.53	0.22				
187	3/25/1999	11	0.022	31.69	0.22				
188	3/26/1992	16	0.022	31.86	0.22				
189	1/29/1983	11	0.022	32.03	0.22				
190	4/14/1971	10	0.021	32.2	0.22				
191	12/15/1988	19	0.021	32.37	0.21				
192	12/5/1998	29	0.021	32.54	0.21				
193	3/28/1998	36	0.021	32.71	0.21				
194	11/21/1978	9	0.02	32.88	0.21				
195	12/28/1974	31	0.02	33.05	0.21				
196	4/1/1999	13	0.02	33.22	0.21				
197	10/11/1987	36	0.02	33.39	0.21				
198	12/20/2002	37	0.02	33.56	0.21				

199	4/6/1986	17	0.02	33.73	0.21				
200	1/4/1973	8	0.02	33.9	0.2				
201	2/4/1999	21	0.02	34.07	0.2				
202	12/17/1991	10	0.02	34.24	0.2				
203	6/9/1990	29	0.02	34.41	0.2				
204	3/25/1980	8	0.02	34.58	0.2				
205	4/19/1983	26	0.02	34.75	0.2				
206	9/23/1986	49	0.02	34.92	0.2				
207	1/16/1970	9	0.019	35.08	0.2				
208	1/15/1998	18	0.019	35.25	0.2				
209	1/7/1995	18	0.019	35.42	0.2				
210	1/3/1991	21	0.019	35.59	0.2				
211	11/24/1978	12	0.019	35.76	0.19				
212	12/24/1983	66	0.019	35.93	0.19				
213	4/7/1978	8	0.019	36.1	0.19				
214	4/28/1980	8	0.019	36.27	0.19				
215	3/28/2006	8	0.019	36.44	0.19				
216	1/2/1990	9	0.019	36.61	0.19				
217	3/10/1986	15	0.019	36.78	0.19				
218	1/25/1999	53	0.018	36.95	0.19				
219	12/28/1989	9	0.018	37.12	0.19				
220	12/11/1993	10	0.018	37.29	0.19				
221	1/21/1995	8	0.018	37.46	0.19				
222	11/18/1973	11	0.018	37.63	0.18				
223	3/27/1979	44	0.018	37.8	0.18				
224	12/29/1992	7	0.018	37.97	0.18				
225	3/21/1983	12	0.018	38.14	0.18				
226	2/24/1983	9	0.018	38.31	0.18				
227	1/31/1996	31	0.018	38.47	0.18				
228	12/6/1986	35	0.018	38.64	0.18				
229	12/7/2007	47	0.018	38.81	0.18				
230	1/18/1973	9	0.017	38.98	0.18				
231	1/31/1990	7	0.017	39.15	0.18				
232	12/22/1982	9	0.017	39.32	0.18				
233	4/4/2006	23	0.017	39.49	0.18				
234	1/18/1969	67	0.017	39.66	0.18				
235	4/4/1990	8	0.017	39.83	0.17				
236	2/7/1978	7	0.017	40	0.17				
237	5/22/2006	14	0.017	40.17	0.17				
238	3/23/1995	7	0.017	40.34	0.17				
239	2/23/1987	65	0.016	40.51	0.17				
240	12/16/1984	10	0.016	40.68	0.17				

241	2/3/2004	8	0.016	40.85	0.17					
242	4/16/1995	14	0.016	41.02	0.17					
243	2/3/1994	34	0.016	41.19	0.17					
244	11/28/1998	12	0.016	41.36	0.17					
245	10/20/1979	14	0.016	41.53	0.17					
246	12/7/1984	8	0.016	41.69	0.17					
247	2/7/1994	32	0.016	41.86	0.17					
248	3/21/2006	8	0.016	42.03	0.17					
249	1/25/1994	15	0.016	42.2	0.16					
250	12/8/1982	37	0.016	42.37	0.16					
251	2/18/2006	23	0.016	42.54	0.16					
252	3/7/1992	27	0.016	42.71	0.16					
253	3/28/1993	7	0.015	42.88	0.16					
254	4/20/2007	11	0.015	43.05	0.16					
255	5/5/2005	6	0.015	43.22	0.16					
256	12/9/1983	7	0.015	43.39	0.16					
257	2/8/1986	22	0.015	43.56	0.16					
258	1/30/1978	7	0.015	43.73	0.16					
259	12/21/1997	13	0.015	43.9	0.16					
260	3/8/1986	15	0.015	44.07	0.16					
261	10/26/1996	7	0.015	44.24	0.16					
262	11/20/1983	12	0.015	44.41	0.16					
263	9/10/1976	25	0.015	44.58	0.16					
264	2/14/2008	10	0.014	44.75	0.16					
265	2/4/1990	7	0.014	44.92	0.15					
266	12/9/1996	16	0.014	45.08	0.15					
267	1/28/2005	10	0.014	45.25	0.15					
268	11/24/1985	65	0.014	45.42	0.15					
269	12/28/1991	6	0.014	45.59	0.15					
270	4/17/2000	7	0.014	45.76	0.15					
271	2/29/1988	34	0.014	45.93	0.15					
272	12/25/1968	19	0.014	46.1	0.15					
273	2/9/1978	35	0.014	46.27	0.15					
274	3/12/1996	34	0.014	46.44	0.15					
275	10/28/1974	28	0.014	46.61	0.15					
276	2/3/2008	19	0.014	46.78	0.15					
277	4/3/1987	9	0.014	46.95	0.15					
278	2/6/1973	13	0.014	47.12	0.15					
279	1/29/1998	14	0.014	47.29	0.15					
280	2/21/1979	6	0.014	47.46	0.15					
281	10/28/1987	10	0.014	47.63	0.15					
282	12/14/1993	6	0.014	47.8	0.15					

283	1/6/1987	15	0.014	47.97	0.14					
284	1/9/1991	6	0.014	48.14	0.14					
285	1/30/1986	10	0.014	48.31	0.14					
286	4/1/1968	6	0.013	48.47	0.14					
287	1/21/1996	14	0.013	48.64	0.14					
288	12/28/1977	19	0.013	48.81	0.14					
289	1/19/1983	8	0.013	48.98	0.14					
290	1/20/1982	25	0.013	49.15	0.14					
291	11/28/1982	50	0.013	49.32	0.14					
292	4/17/1990	8	0.013	49.49	0.14					
293	12/27/1992	13	0.013	49.66	0.14					
294	11/8/1998	10	0.013	49.83	0.14					
295	11/11/1978	25	0.013	50	0.14					
296	11/29/1985	21	0.013	50.17	0.14					
297	12/31/2005	50	0.013	50.34	0.14					
298	3/20/1992	16	0.013	50.51	0.14					
299	11/26/1973	6	0.013	50.68	0.14					
300	1/16/1984	6	0.013	50.85	0.14					
301	3/8/1973	7	0.013	51.02	0.14					
302	12/8/1969	9	0.013	51.19	0.14					
303	2/12/2000	8	0.013	51.36	0.14					
304	10/25/1971	6	0.013	51.53	0.13					
305	10/14/2006	11	0.013	51.69	0.13					
306	12/13/1971	6	0.013	51.86	0.13					
307	2/19/1998	33	0.013	52.03	0.13					
308	12/9/1970	6	0.012	52.2	0.13					
309	2/24/2008	9	0.012	52.37	0.13					
310	3/31/1998	32	0.012	52.54	0.13					
311	2/18/2004	9	0.012	52.71	0.13					
312	11/14/1988	8	0.012	52.88	0.13					
313	2/22/2007	5	0.012	53.05	0.13					
314	2/5/1978	8	0.012	53.22	0.13					
315	3/31/1992	32	0.012	53.39	0.13					
316	10/9/1986	14	0.012	53.56	0.13					
317	12/18/1984	51	0.012	53.73	0.13					
318	9/5/1978	7	0.012	53.9	0.13					
319	4/25/1994	59	0.012	54.07	0.13					
320	11/24/2001	5	0.012	54.24	0.13					
321	10/31/1987	22	0.012	54.41	0.13					
322	2/9/1989	15	0.012	54.58	0.13					
323	3/29/1982	11	0.012	54.75	0.13					
324	11/14/1972	6	0.012	54.92	0.13					

325	12/22/1971	6	0.012	55.08	0.13					
326	10/26/2000	34	0.012	55.25	0.13					
327	4/26/2002	13	0.012	55.42	0.13					
328	4/17/2003	7	0.012	55.59	0.13					
329	5/28/1971	7	0.012	55.76	0.12					
330	2/2/1985	17	0.011	55.93	0.12					
331	2/25/1996	19	0.011	56.1	0.12					
332	3/21/1969	9	0.011	56.27	0.12					
333	4/1/2004	5	0.011	56.44	0.12					
334	12/18/1988	8	0.011	56.61	0.12					
335	12/19/1987	21	0.011	56.78	0.12					
336	3/28/1990	10	0.011	56.95	0.12					
337	3/25/1982	12	0.011	57.12	0.12					
338	1/2/1977	12	0.011	57.29	0.12					
339	1/5/1982	14	0.011	57.46	0.12					
340	10/22/1987	10	0.011	57.63	0.12					
341	12/25/1977	31	0.011	57.8	0.12					
342	10/17/2005	17	0.011	57.97	0.12					
343	4/6/1984	6	0.011	58.14	0.12					
344	3/3/2006	4	0.011	58.31	0.12					
345	12/20/1986	15	0.011	58.47	0.12					
346	3/25/1977	5	0.011	58.64	0.12					
347	12/7/1972	44	0.011	58.81	0.12					
348	2/28/2007	4	0.011	58.98	0.12					
349	12/18/1992	4	0.011	59.15	0.12					
350	4/23/1980	5	0.011	59.32	0.12					
351	2/9/1975	28	0.011	59.49	0.12					
352	4/29/1983	5	0.011	59.66	0.12					
353	1/21/2001	4	0.011	59.83	0.12					
354	12/29/2002	8	0.011	60	0.12					
355	11/6/1969	10	0.011	60.17	0.12					
356	3/3/1980	13	0.011	60.34	0.12					
357	5/7/1971	10	0.01	60.51	0.11					
358	2/27/2003	7	0.01	60.68	0.11					
359	11/15/1969	5	0.01	60.85	0.11					
360	1/3/1978	5	0.01	61.02	0.11					
361	4/23/1990	4	0.01	61.19	0.11					
362	3/2/2004	9	0.01	61.36	0.11					
363	3/17/2002	9	0.01	61.53	0.11					
364	11/12/2001	5	0.01	61.69	0.11					
365	11/8/1984	7	0.01	61.86	0.11					
366	12/11/2007	5	0.01	62.03	0.11					

367	1/18/1979	15	0.01	62.2	0.11					
368	11/12/2003	6	0.01	62.37	0.11					
369	12/12/1975	13	0.01	62.54	0.11					
370	11/27/1975	32	0.01	62.71	0.11					
371	4/15/1998	5	0.01	62.88	0.11					
372	4/22/2001	4	0.01	63.05	0.11					
373	10/21/1976	4	0.01	63.22	0.11					
374	1/12/1971	5	0.01	63.39	0.11					
375	1/2/2004	9	0.01	63.56	0.11					
376	2/16/2000	4	0.01	63.73	0.11					
377	1/29/2007	37	0.01	63.9	0.11					
378	11/19/1990	19	0.01	64.07	0.11					
379	11/1/1995	20	0.01	64.24	0.11					
380	9/22/1987	23	0.01	64.41	0.11					
381	11/19/1982	4	0.01	64.58	0.11					
382	1/28/1982	12	0.01	64.75	0.11					
383	1/31/1986	9	0.01	64.92	0.11					
384	1/19/1998	6	0.01	65.08	0.11					
385	12/3/1983	5	0.01	65.25	0.11					
386	12/23/1995	4	0.01	65.42	0.11					
387	1/5/1978	4	0.009	65.59	0.11					
388	4/14/2006	11	0.009	65.76	0.11					
389	1/3/1998	28	0.009	65.93	0.11					
390	5/28/1990	14	0.009	66.1	0.11					
391	3/27/1974	5	0.009	66.27	0.1					
392	12/2/1985	21	0.009	66.44	0.1					
393	1/5/1992	80	0.009	66.61	0.1					
394	1/10/1970	9	0.009	66.78	0.1					
395	3/10/1969	4	0.009	66.95	0.1					
396	12/21/2001	12	0.009	67.12	0.1					
397	3/15/1991	4	0.009	67.29	0.1					
398	11/11/1983	34	0.009	67.46	0.1					
399	1/30/1975	11	0.009	67.63	0.1					
400	3/4/1996	10	0.009	67.8	0.1					
401	12/11/1996	17	0.009	67.97	0.1					
402	4/11/1998	5	0.009	68.14	0.1					
403	3/15/1999	4	0.009	68.31	0.1					
404	4/15/1976	4	0.009	68.47	0.1					
405	12/19/1990	40	0.009	68.64	0.1					
406	1/28/1985	15	0.009	68.81	0.1					
407	12/25/1994	9	0.009	68.98	0.1					
408	12/18/1977	10	0.009	69.15	0.1					

409	12/16/2006	15	0.009	69.32	0.1					
410	12/6/2004	45	0.009	69.49	0.1					
411	1/13/1998	5	0.008	69.66	0.1					
412	1/11/1981	14	0.008	69.83	0.1					
413	11/7/1979	7	0.008	70	0.1					
414	12/10/1985	23	0.008	70.17	0.1					
415	2/28/1973	3	0.008	70.34	0.1					
416	2/26/1993	5	0.008	70.51	0.1					
417	3/16/2008	4	0.008	70.68	0.1					
418	3/13/1969	11	0.008	70.85	0.1					
419	1/15/1995	45	0.008	71.02	0.1					
420	1/8/2001	16	0.008	71.19	0.1					
421	1/3/2002	3	0.008	71.36	0.1					
422	12/27/2006	3	0.008	71.53	0.1					
423	10/7/1983	5	0.008	71.69	0.1					
424	12/23/1977	3	0.008	71.86	0.1					
425	4/18/1983	3	0.008	72.03	0.1					
426	10/5/1977	15	0.008	72.2	0.1					
427	3/13/1986	12	0.008	72.37	0.1					
428	9/16/1978	5	0.008	72.54	0.1					
429	1/24/1983	4	0.008	72.71	0.1					
430	2/27/1996	11	0.008	72.88	0.1					
431	3/22/1975	4	0.008	73.05	0.1					
432	1/5/1984	5	0.008	73.22	0.09					
433	1/10/1982	10	0.008	73.39	0.09					
434	4/5/1975	29	0.008	73.56	0.09					
435	2/15/1973	3	0.008	73.73	0.09					
436	2/3/1975	51	0.007	73.9	0.09					
437	12/28/1996	3	0.007	74.07	0.09					
438	11/30/1993	3	0.007	74.24	0.09					
439	1/2/1993	6	0.007	74.41	0.09					
440	3/7/1973	9	0.007	74.58	0.09					
441	3/13/1991	5	0.007	74.75	0.09					
442	1/9/1973	11	0.007	74.92	0.09					
443	3/13/1971	3	0.007	75.08	0.09					
444	2/10/1997	4	0.007	75.25	0.09					
445	3/24/2005	6	0.007	75.42	0.09					
446	3/4/1969	3	0.007	75.59	0.09					
447	11/22/1993	6	0.007	75.76	0.09					
448	2/14/1979	3	0.007	75.93	0.09					
449	12/17/1970	6	0.007	76.1	0.09					
450	12/1/1998	8	0.007	76.27	0.09					

451	4/18/1996	5	0.006	76.44	0.09					
452	3/11/1999	3	0.006	76.61	0.09					
453	1/20/1999	17	0.006	76.78	0.09					
454	1/28/1979	3	0.006	76.95	0.09					
455	3/12/1986	4	0.006	77.12	0.09					
456	3/14/1975	3	0.006	77.29	0.09					
457	2/2/1989	17	0.006	77.46	0.09					
458	4/17/2004	4	0.006	77.63	0.09					
459	1/29/2008	3	0.006	77.8	0.09					
460	11/29/2001	3	0.006	77.97	0.09					
461	12/4/1980	7	0.006	78.14	0.09					
462	11/29/2002	4	0.006	78.31	0.09					
463	10/19/1972	4	0.006	78.47	0.09					
464	11/8/2002	28	0.006	78.64	0.09					
465	2/22/1996	4	0.006	78.81	0.09					
466	2/9/1985	9	0.006	78.98	0.09					
467	12/19/1993	3	0.006	79.15	0.09					
468	4/15/1978	3	0.006	79.32	0.09					
469	12/6/1996	7	0.005	79.49	0.09					
470	1/5/1988	4	0.005	79.66	0.09					
471	1/7/1985	22	0.005	79.83	0.09					
472	12/19/2007	8	0.005	80	0.09					
473	5/3/2003	4	0.005	80.17	0.09					
474	12/7/2003	4	0.005	80.34	0.09					
475	2/19/1971	3	0.005	80.51	0.09					
476	12/22/2006	7	0.005	80.68	0.09					
477	1/29/2002	8	0.005	80.85	0.09					
478	9/3/1998	4	0.005	81.02	0.09					
479	11/30/1999	2	0.005	81.19	0.09					
480	3/18/2006	2	0.005	81.36	0.09					
481	2/3/1973	2	0.005	81.53	0.09					
482	10/28/1998	2	0.005	81.69	0.09					
483	1/3/1992	6	0.005	81.86	0.08					
484	2/4/1989	5	0.005	82.03	0.08					
485	1/28/1968	4	0.005	82.2	0.08					
486	10/7/1985	15	0.005	82.37	0.08					
487	12/3/1999	3	0.005	82.54	0.08					
488	10/25/1989	7	0.005	82.71	0.08					
489	1/19/1978	9	0.005	82.88	0.08					
490	9/6/1972	7	0.005	83.05	0.08					
491	11/13/1984	2	0.005	83.22	0.08					
492	5/7/1976	3	0.005	83.39	0.08					

493	2/28/1969	1	0.005	83.56	0.08					
494	1/16/1996	2	0.005	83.73	0.08					
495	12/23/1988	2	0.005	83.9	0.08					
496	1/2/1971	2	0.005	84.07	0.08					
497	12/11/2003	2	0.005	84.24	0.08					
498	2/17/2002	8	0.005	84.41	0.08					
499	4/26/1971	2	0.005	84.58	0.08					
501	1/5/1989	18	0.004	84.92	0.08					
501	1/25/1996	2	0.004	84.92	0.08					
502	3/6/1983	6	0.004	85.08	0.08					
503	2/23/1979	2	0.004	85.25	0.08					
504	10/20/1984	6	0.004	85.42	0.08					
505	12/8/1991	5	0.004	85.59	0.08					
506	11/18/1987	1	0.004	85.76	0.08					
507	12/3/1984	2	0.004	85.93	0.08					
508	9/26/1999	1	0.004	86.1	0.08					
509	1/28/1996	2	0.004	86.27	0.08					
510	11/10/1969	2	0.004	86.44	0.08					
511	1/23/1983	2	0.004	86.61	0.08					
512	5/12/1998	4	0.004	86.78	0.08					
513	12/10/2001	1	0.004	86.95	0.08					
514	12/1/1983	1	0.004	87.12	0.08					
515	2/13/1968	13	0.004	87.29	0.08					
516	12/3/2001	18	0.004	87.46	0.08					
517	1/4/1989	1	0.004	87.63	0.08					
518	3/26/2008	2	0.003	87.8	0.08					
519	3/26/1973	5	0.003	87.97	0.08					
520	12/4/1992	1	0.003	88.14	0.08					
521	11/14/1993	2	0.003	88.31	0.08					
522	4/23/2007	1	0.003	88.47	0.08					
523	10/11/2000	1	0.003	88.64	0.08					
524	2/13/1987	12	0.003	88.81	0.08					
526	8/14/1983	1	0.003	89.15	0.08					
526	8/17/1999	1	0.003	89.15	0.08					
527	3/23/2002	2	0.003	89.32	0.08					
528	1/17/1980	3	0.003	89.49	0.08					
531	2/15/1987	2	0.003	90	0.08					
531	2/4/2004	2	0.003	90	0.08					
531	2/4/1985	2	0.003	90	0.08					
532	3/7/2006	1	0.003	90.17	0.08					
533	1/4/2007	1	0.003	90.34	0.08					
534	3/16/1977	4	0.003	90.51	0.08					

535	10/13/2007	4	0.003	90.68	0.08					
536	1/22/2008	2	0.003	90.85	0.08					
537	12/2/1970	1	0.003	91.02	0.08					
538	11/27/1981	1	0.003	91.19	0.08					
539	1/7/1975	1	0.003	91.36	0.08					
540	11/14/1987	2	0.003	91.53	0.08					
541	8/7/1983	1	0.003	91.69	0.08					
542	12/10/2006	1	0.003	91.86	0.08					
543	11/1/2003	3	0.002	92.03	0.08					
544	11/5/2001	1	0.002	92.2	0.08					
545	3/17/1968	2	0.002	92.37	0.08					
546	2/21/1994	13	0.002	92.54	0.08					
547	10/17/1984	1	0.002	92.71	0.07					
548	10/17/2004	1	0.002	92.88	0.07					
549	4/24/2002	2	0.002	93.05	0.07					
554	9/29/1983	1	0.002	93.9	0.07					
554	9/19/1989	1	0.002	93.9	0.07					
554	9/20/2005	1	0.002	93.9	0.07					
554	4/24/1994	2	0.002	93.9	0.07					
554	9/28/1982	1	0.002	93.9	0.07					
555	5/6/1995	1	0.002	94.07	0.07					
556	4/18/1988	1	0.002	94.24	0.07					
557	8/18/1999	1	0.002	94.41	0.07					
558	6/15/1995	1	0.002	94.58	0.07					
559	7/10/1996	1	0.002	94.75	0.07					
560	7/31/1991	1	0.002	94.92	0.07					
561	1/10/1993	2	0.002	95.08	0.07					
562	3/25/1975	1	0.002	95.25	0.07					
563	11/1/1974	1	0.002	95.42	0.07					
564	10/28/1981	1	0.002	95.59	0.07					
565	12/22/1973	3	0.002	95.76	0.07					
566	3/14/1979	1	0.002	95.93	0.07					
567	5/13/1995	2	0.002	96.1	0.07					
568	3/22/1973	1	0.002	96.27	0.07					
569	3/8/2000	1	0.002	96.44	0.07					
570	12/10/1972	1	0.002	96.61	0.07					
571	11/30/1997	1	0.002	96.78	0.07					
574	12/12/2000	1	0.002	97.29	0.07					
574	12/3/2005	1	0.002	97.29	0.07					
574	1/3/1999	1	0.002	97.29	0.07					
575	3/2/1974	1	0.002	97.46	0.07					
576	10/23/1991	1	0.002	97.63	0.07					

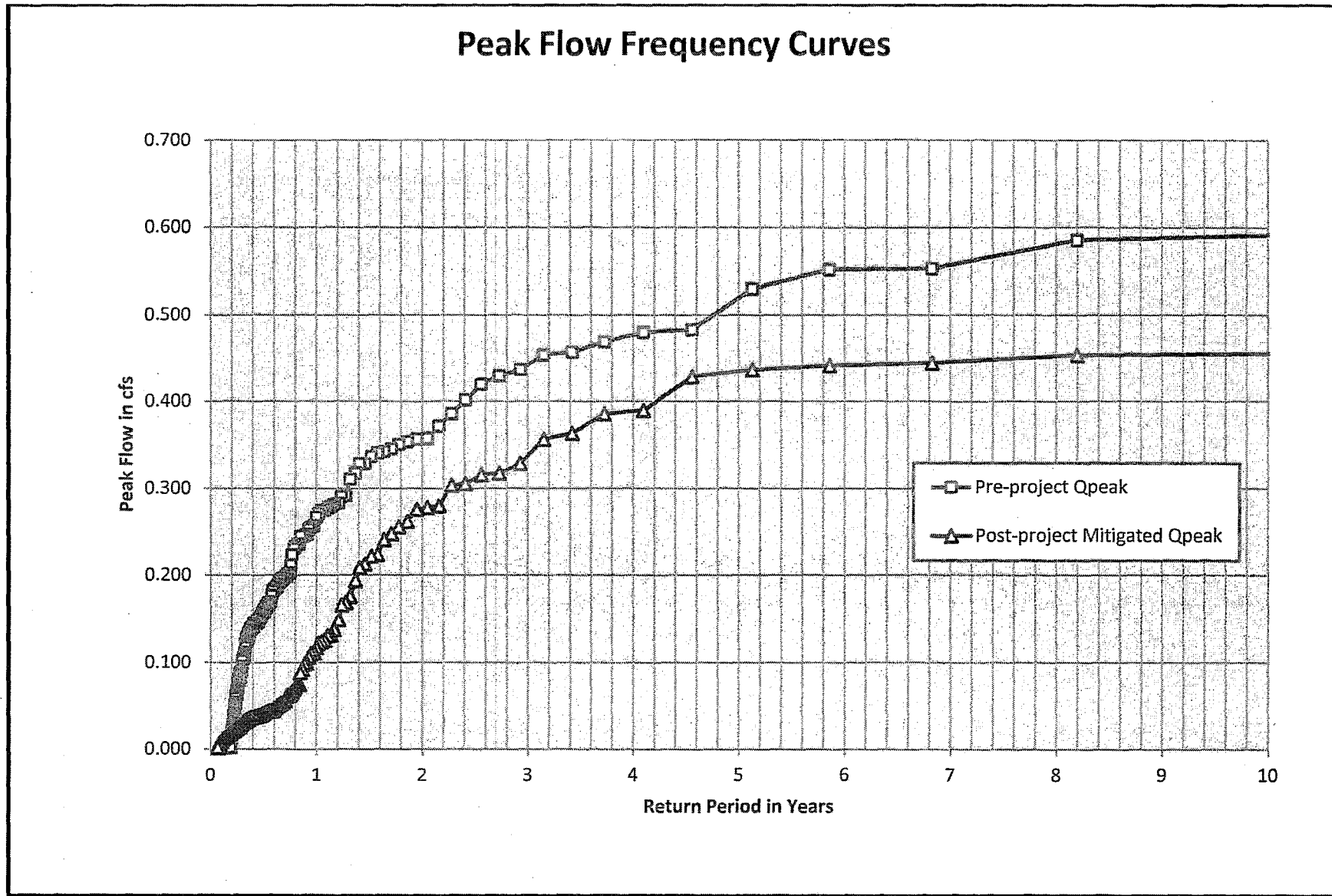
577	10/23/1992	1	0.002	97.8	0.07					
581	11/10/2005	1	0.002	98.47	0.07					
581	11/8/1999	1	0.002	98.47	0.07					
581	11/27/2006	1	0.002	98.47	0.07					
581	11/8/1972	1	0.002	98.47	0.07					
584	3/1/1985	1	0.002	98.98	0.07					
584	3/29/1985	1	0.002	98.98	0.07					
584	3/11/1990	1	0.002	98.98	0.07					
585	4/21/2001	7	0.002	99.15	0.07					
586	9/19/1985	1	0.002	99.32	0.07					
589	10/30/1992	1	0.002	99.83	0.07					
589	10/1/1983	1	0.002	99.83	0.07					
589	10/11/1993	1	0.002	99.83	0.07					

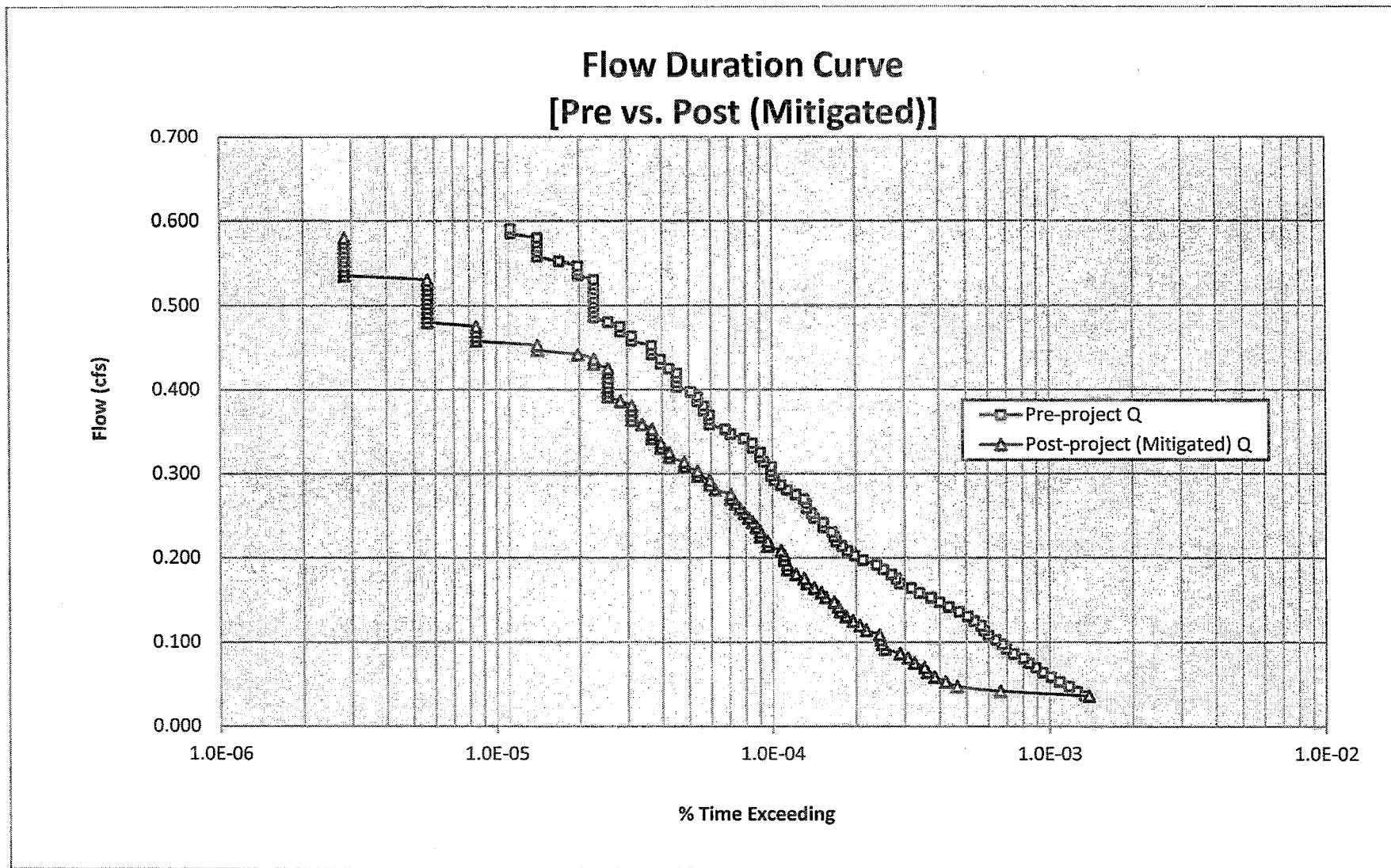
Output for Basin B

Peak Flow Frequency Summary

The Peak Flow Frequency is based on the 40 years of rainfall data for the Fashion Valley Rain Gage. A statistical analysis of the data is depicted in the sheets above attached sheets for pre and post project scenarios.

Return Period	Pre-project Qpeak (cfs)	Post-project - Mitigated Q (cfs)
LF = 0.1xQ2	0.037	0.028
2-year	0.367	0.281
5-year	0.486	0.466
10-year	0.591	0.456





Low-flow Threshold: 10%
 0.1xQ2 (Pre): 0.037 cfs
 Q10 (Pre): 0.591 cfs
 Ordinate #: 100
 Incremental Q (Pre): 0.00555 cfs
 Total Hourly Data: 353902 hours

The proposed BMP: **PASSED**

Interval	Pre-project Flow (cfs)	Pre-project Hours	Pre-project % Time Exceeding	Post-project Hours	Post-project % Time Exceeding	Percentage	Pass/Fail
0	0.037	472	1.33E-03	490	1.38E-03	104%	Pass
1	0.042	443	1.25E-03	235	6.64E-04	53%	Pass
2	0.048	416	1.18E-03	164	4.63E-04	39%	Pass
3	0.053	384	1.09E-03	149	4.21E-04	39%	Pass
4	0.059	358	1.01E-03	136	3.84E-04	38%	Pass
5	0.064	334	9.44E-04	128	3.62E-04	38%	Pass
6	0.070	315	8.90E-04	125	3.53E-04	40%	Pass
7	0.075	298	8.42E-04	115	3.25E-04	39%	Pass
8	0.081	285	8.05E-04	109	3.08E-04	38%	Pass
9	0.087	262	7.40E-04	102	2.88E-04	39%	Pass
10	0.092	247	6.98E-04	90	2.54E-04	36%	Pass
11	0.098	239	6.75E-04	88	2.49E-04	37%	Pass
12	0.103	226	6.39E-04	87	2.46E-04	38%	Pass
13	0.109	213	6.02E-04	86	2.43E-04	40%	Pass
14	0.114	205	5.79E-04	77	2.18E-04	38%	Pass
15	0.120	200	5.65E-04	73	2.06E-04	37%	Pass
16	0.125	189	5.34E-04	69	1.95E-04	37%	Pass
17	0.131	179	5.06E-04	65	1.84E-04	36%	Pass
18	0.136	167	4.72E-04	62	1.75E-04	37%	Pass
19	0.142	153	4.32E-04	61	1.72E-04	40%	Pass
20	0.148	142	4.01E-04	59	1.67E-04	42%	Pass
21	0.153	132	3.73E-04	55	1.55E-04	42%	Pass
22	0.159	120	3.39E-04	53	1.50E-04	44%	Pass
23	0.164	112	3.16E-04	50	1.41E-04	45%	Pass
24	0.170	102	2.88E-04	47	1.33E-04	46%	Pass
25	0.175	99	2.80E-04	46	1.30E-04	46%	Pass
26	0.181	95	2.68E-04	43	1.22E-04	45%	Pass
27	0.186	89	2.51E-04	40	1.13E-04	45%	Pass

28	0.192	84	2.37E-04	40	1.13E-04	48%	Pass
29	0.198	75	2.12E-04	39	1.10E-04	52%	Pass
30	0.203	70	1.98E-04	39	1.10E-04	56%	Pass
31	0.209	66	1.86E-04	38	1.07E-04	58%	Pass
32	0.214	63	1.78E-04	34	9.61E-05	54%	Pass
33	0.220	60	1.70E-04	34	9.61E-05	57%	Pass
34	0.225	59	1.67E-04	32	9.04E-05	54%	Pass
35	0.231	58	1.64E-04	32	9.04E-05	55%	Pass
36	0.236	54	1.53E-04	31	8.76E-05	57%	Pass
37	0.242	54	1.53E-04	30	8.48E-05	56%	Pass
38	0.247	50	1.41E-04	29	8.19E-05	58%	Pass
39	0.253	49	1.38E-04	28	7.91E-05	57%	Pass
40	0.259	47	1.33E-04	27	7.63E-05	57%	Pass
41	0.264	47	1.33E-04	26	7.35E-05	55%	Pass
42	0.270	46	1.30E-04	25	7.06E-05	54%	Pass
43	0.275	43	1.22E-04	25	7.06E-05	58%	Pass
44	0.281	40	1.13E-04	22	6.22E-05	55%	Pass
45	0.286	38	1.07E-04	21	5.93E-05	55%	Pass
46	0.292	36	1.02E-04	21	5.93E-05	58%	Pass
47	0.297	35	9.89E-05	19	5.37E-05	54%	Pass
48	0.303	35	9.89E-05	19	5.37E-05	54%	Pass
49	0.308	35	9.89E-05	17	4.80E-05	49%	Pass
50	0.314	33	9.32E-05	17	4.80E-05	52%	Pass
51	0.320	32	9.04E-05	15	4.24E-05	47%	Pass
52	0.325	32	9.04E-05	15	4.24E-05	47%	Pass
53	0.331	30	8.48E-05	14	3.96E-05	47%	Pass
54	0.336	30	8.48E-05	14	3.96E-05	47%	Pass
55	0.342	28	7.91E-05	13	3.67E-05	46%	Pass
56	0.347	25	7.06E-05	13	3.67E-05	52%	Pass
57	0.353	24	6.78E-05	13	3.67E-05	54%	Pass
58	0.358	21	5.93E-05	12	3.39E-05	57%	Pass
59	0.364	21	5.93E-05	11	3.11E-05	52%	Pass
60	0.369	21	5.93E-05	11	3.11E-05	52%	Pass
61	0.375	20	5.65E-05	11	3.11E-05	55%	Pass
62	0.381	20	5.65E-05	11	3.11E-05	55%	Pass
63	0.386	19	5.37E-05	10	2.83E-05	53%	Pass
64	0.392	19	5.37E-05	9	2.54E-05	47%	Pass
65	0.397	18	5.09E-05	9	2.54E-05	50%	Pass
66	0.403	16	4.52E-05	9	2.54E-05	56%	Pass
67	0.408	16	4.52E-05	9	2.54E-05	56%	Pass
68	0.414	16	4.52E-05	9	2.54E-05	56%	Pass
69	0.419	16	4.52E-05	9	2.54E-05	56%	Pass

70	0.425	15	4.24E-05	9	2.54E-05	60%	Pass
71	0.430	14	3.96E-05	8	2.26E-05	57%	Pass
72	0.436	14	3.96E-05	8	2.26E-05	57%	Pass
73	0.442	13	3.67E-05	7	1.98E-05	54%	Pass
74	0.447	13	3.67E-05	5	1.41E-05	38%	Pass
75	0.453	13	3.67E-05	5	1.41E-05	38%	Pass
76	0.458	11	3.11E-05	3	8.48E-06	27%	Pass
77	0.464	11	3.11E-05	3	8.48E-06	27%	Pass
78	0.469	10	2.83E-05	3	8.48E-06	30%	Pass
79	0.475	10	2.83E-05	3	8.48E-06	30%	Pass
80	0.480	9	2.54E-05	2	5.65E-06	22%	Pass
81	0.486	8	2.26E-05	2	5.65E-06	25%	Pass
82	0.491	8	2.26E-05	2	5.65E-06	25%	Pass
83	0.497	8	2.26E-05	2	5.65E-06	25%	Pass
84	0.503	8	2.26E-05	2	5.65E-06	25%	Pass
85	0.508	8	2.26E-05	2	5.65E-06	25%	Pass
86	0.514	8	2.26E-05	2	5.65E-06	25%	Pass
87	0.519	8	2.26E-05	2	5.65E-06	25%	Pass
88	0.525	8	2.26E-05	2	5.65E-06	25%	Pass
89	0.530	8	2.26E-05	2	5.65E-06	25%	Pass
90	0.536	7	1.98E-05	1	2.83E-06	14%	Pass
91	0.541	7	1.98E-05	1	2.83E-06	14%	Pass
92	0.547	7	1.98E-05	1	2.83E-06	14%	Pass
93	0.552	6	1.70E-05	1	2.83E-06	17%	Pass
94	0.558	5	1.41E-05	1	2.83E-06	20%	Pass
95	0.564	5	1.41E-05	1	2.83E-06	20%	Pass
96	0.569	5	1.41E-05	1	2.83E-06	20%	Pass
97	0.575	5	1.41E-05	1	2.83E-06	20%	Pass
98	0.580	5	1.41E-05	1	2.83E-06	20%	Pass
99	0.586	4	1.13E-05	0	0.00E+00	0%	Pass
100	0.591	4	1.13E-05	0	0.00E+00	0%	Pass

Drawdown Time Calculations- Basin B

Time = Volume/ Flowrate (out)

The flowrate out is determined by the orifice size, see Summary Table Below.

Summary Table of Draw Down Time for Biofiltration Areas Providing Hydromodification								
BMP NO.	ORIFICE DIA. (IN)	AREA (SF)	C	ORIFICE FLOW (CFS)	VOLUME OF PONDED WATER (V1 IN CF)	DRAW DOWN TIME (HOURS)	VOLUME TOTAL	DRAW DOWN TIME (HOURS)
5	0.4375	0.001044	0.67	0.011	210	5.31	1260	31.9
6	0.33	0.000594	0.67	0.006	85	3.78	510	22.7

Appendix E
Soil Investigation

SOILS INVESTIGATION
PROPOSED
MID CITY SKATE PARK
DWIGHT STREET AND 38TH STREET
SAN DIEGO, CALIFORNIA

(K2 Engineering Job No. G2014015-1)

Prepared for:

Schmidt Design Group

December 10, 2013



December 10, 2014

Mr. Jeff Justus
Schmidt Design Group
1111 Sixth Avenue, Suite 500
San Diego, CA 92101

(K2 Engineering Job No. G2014015-1)

Dear Mr. Justus:

We are pleased to submit our report of "Soils Investigation, Proposed Mid City Skate Park, San Diego, California."

The results of our field explorations and laboratory tests, along with recommendations for earthwork and for design of the proposed park improvements are presented in this report.

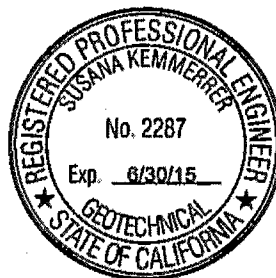
Please call us if you have any questions or if we can be of further service to you on this or future projects. It has been a pleasure working with you.

Respectfully submitted,

K2 ENGINEERING, INC.

A handwritten signature in black ink, appearing to read 'Susana Kemmerrer'.

Susana Kemmerrer, RGE 2287
President



K2/Reports/SCHMIDT DESIGN/Mid City Skate Park G2014015-1 Final.doc



**SOILS INVESTIGATION
PROPOSED
MID CITY SKATE PARK
DWIGHT STREET AND 38TH STREET
SAN DIEGO, CALIFORNIA**

(K2 Engineering Job No. G2014015-1)

12595 RAGWEED STREET, SAN DIEGO, CALIFORNIA 92129 • PHONE (858)484-2347 • FAX (858)484-8682

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Appendix A Explorations and Laboratory Tests

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1.0 SUMMARY

This report presents the results of our soils investigation performed to provide earthwork and foundation recommendations for the proposed Mid City Skate Park. The skate park is planned within the existing Park De La Cruz located northeast of the intersection of 38th and Dwight Streets in San Diego, California. The locations of the exploratory excavations performed are presented on Plate 1, Site Plan. A summary of our findings and recommendations is presented below.

- Fill soils extending to the maximum depth explored of 14 feet were encountered at the boring locations. The fill soils were medium dense to dense with abundant gravel and cobbles. The fill soils were reportedly placed during mass grading of the site associated with the construction of the I-15 Freeway to the east. Documentation regarding fill placement was not available for review.
- Groundwater was not encountered in the exploratory borings.
- At their present condition, the existing fill soils are not considered suitable for support of the proposed facilities without improvement. To provide more uniform support, we recommend that the existing fill soils be overexcavated and replaced as compacted fill. The proposed improvements may then be supported on compacted fill. Spread footings established on compacted fill may be used for support of the proposed improvements.
- To reduce the potential for damage due to settlement, subgrade stabilization using geogrid reinforcement and/or gravel may be required beneath the bowls.
- Percolation testing performed on site indicated very slow to moderately slow percolation rates.

- oOo -

2.0 SCOPE

This report presents the results of a soils investigation performed to provide planning and design criteria for the proposed Mid City Skate Park in San Diego, California. The approximate locations of the exploratory excavations are presented in Plate 1, Site Plan.

The purpose of this investigation was to determine the static physical characteristics of the on-site soils; and to provide geotechnical recommendations for foundation design, grading, excavation and backfill for the proposed facilities. More specifically, the scope of the investigation included the following:

- Evaluation of the existing surface and subsurface conditions, including groundwater conditions (if encountered), within the areas of proposed construction.
- Drilling and logging of three borings to a maximum depth of 20 feet or to refusal.
- Performing two percolation tests to evaluate the permeability of the on-site soils.
- Laboratory tests to estimate the physical properties of the onsite materials.
- Providing recommendations for grading.
- Providing recommended foundation systems together with the associated design parameters.
- Presenting general recommendations concerning construction procedures and quality control measures relating to earthwork.

Our recommendations are based on the results of our field explorations, laboratory tests and associated geotechnical analyses. The results of our field explorations and laboratory tests are presented in Appendix A. This investigation did not include studies to assess the environmental hazards that may affect the site however, this does not imply that such hazards affect the site.

Our professional services have been performed using that degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical consultants practicing in this or similar localities. No other warranty, express or implied, is made as to the professional advice included in this report. This report has been prepared for Schmidt Design Group and their design consultants to be used solely in the evaluation of the subject project. The report has not been prepared

for use by other parties, and may not contain sufficient information for purposes of other parties or other uses.

3.0 PROJECT DESCRIPTION

The proposed Mid City Skate Park will be located within the existing Park De La Cruz northeast of the intersection of 38th and Dwight Streets, in San Diego, California. According to available information, the proposed park will include a variety of street and vertical features including obstacles, banks and bowls of various depths spread along the length of the project. Vegetated storm water drainage swales are also planned.

With the exception of the bowl features, which may require excavations of up to 9 feet, it is anticipated that the park will be established at about the existing grade. We understand that no building structures are planned at this time.

4.0 SITE CONDITIONS

4.1 EXISTING CONDITIONS

The site is located northeast of the intersection of 38th and Dwight Streets. The proposed skate park site is bound to the west by an existing baseball field, to the north by the Copley Family YMCA and to the east by the Escondido Freeway. According to current plans the proposed skate park will be about 1.25 acres and will encompass the grass area outside the baseball field. The site is relatively flat with numerous large trees and a concrete walkway bordering the baseball field fence.

According to the available information, the site was graded during the mass grading associated with the Escondido Freeway by cutting and filling the previously existing topography.

4.2 SUBSURFACE CONDITIONS

The subsurface conditions were explored by drilling three small-diameter borings extending to depths of 5 to 14 feet below the existing ground surface. In addition, two percolation test holes were excavated to depths of approximately 3 feet. Fill soils extending to the maximum depth explored of 14 feet were encountered in all of the exploratory excavations. The fill soils consisted of medium dense to dense, moist, silty sand with abundant gravel and cobbles. Pieces of concrete were encountered in one of the borings. Refusal in a gravel and cobble layers was encountered at depths of 4 to 14 feet in the exploratory borings.

The fill soils were reportedly placed during rough grading of the area. The composition of the fill, fill depth or the degree of compaction are not known. Documentation regarding earthwork performed during grading of the site was not available for review. Deeper and/or poorer quality fills including the presence of oversized rocks or construction debris may be encountered.

Groundwater was not encountered within any of the borings or percolation test pits to the depths explored. However, groundwater conditions could develop and/or seepage may occur depending on annual precipitation and irrigation. Seepage may occur along lithologic changes within the on-site soils and at the interface between the fill and the less permeable formational materials.

5.0 PERCOLATION TESTS

Two percolations tests were performed to evaluate the infiltration characteristics of the on-site materials and to provide information for the design of the proposed water retention facilities. The approximate percolation test locations are presented on Plate 1, Site Plan.

The percolation tests were performed in accordance with the general guidelines of the San Diego County Public Health Department. The results of the tests are presented in Table 1, Percolation Test Results. The tests results are indicative of the permeability of the on-site soils at their current condition. Percolation rates will be affected by future construction activity such as earthmoving and compaction.

The percolation tests consisted of drilling two 8-inch diameter test holes extending to a depth of approximately 3 feet on October 28, 2014. A minimum of 12 inches of clean water was carefully poured into the percolation holes and presoaked for a minimum of 6 hours. At the end of the presoaking, water was left in the holes overnight.

Percolation testing was performed on October 29, 2014. Saturated soil (mud) and caving of the side walls to depths of 12 to 18 inches was observed prior to start of the percolation tests. The loose materials were removed and about 6 inches of pea gravel was added to the bottom of the holes. Clean water was added to each of the holes and the variations in the water level were measured at approximate 30 minute intervals for a total of four hours for PMC-1. Readings in PMC-2 were stopped after 2 hours when no change in waster level was recorded on four consecutive readings. Refilling of the holes was performed as needed to maintain the water level at the start of each interval. The average of the last three 30-minute interval readings was used to determine the percolation rate. The percolation test results indicate a range of percolation rates of about 0 to 87 minutes per inch (mpi). According to the USDA the soils are considered to have a very slow to moderately slow flow rate.

Table 1, Percolation Test Results

Test Number	Percolation Rate (min/inch)	Permeability (in/hr)	Rate of Flow ⁽¹⁾
PMC-1	87	0.69	Moderately Slow
PMC-2	Did not percolate	0	Very Slow

⁽¹⁾Based on USDA Soil Survey Glossary

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 GENERAL

At the locations drilled, the fill soils consist of medium dense to dense silty sand with abundant gravel and cobbles. Some pieces of concrete were encountered in one of the borings.

The fill soils within the site were reportedly placed during mass grading operations associated with the construction of the Escondido Freeway. The fill characteristics including depth, degree of compaction and composition are not known. It is possible that oversized materials, including construction debris, were placed within the fill. Documentation regarding fill placement was not available for review. Additional studies will be required if future structures are planned.

We understand that the proposed park improvements will be established at about the existing grade. No significant cuts and/or fills are planned. Excavations of up to 9 feet may be required for some of the proposed bowl features.

To provide more uniform support and to reduce the potential for damage due to differential movement, we recommend that the fill soils be overexcavated and replaced as compacted fill soils. As an alternative to complete removal and replacement, if the risk of some settlement is acceptable, the existing fill soils may be overexcavated to allow the placement of at least 3 feet of compacted fill beneath the proposed bowls. Overexcavation should extend at least 5 feet beyond the limits to the bowl(s) or footings. To provide more uniform support or if soft or loose materials are encountered at the overexcavated depth, geogrid layers within the compacted fill and/or a 1-foot layer of gravel may be required.

Beneath paved and/or hardscaped areas a minimum of overexcavation depth of 2 feet below the finished subgrade is recommended.

6.2 FOUNDATIONS

6.2.1 Bearing Value

To provide more uniform support, we recommend that footings extend at least 1½ feet below the lowest adjacent final grade. A bearing value of 2,000 pounds per square foot may be used for footings at least 12 inches in width and supported on at least 2 feet of compacted fill soils. A modulus of subgrade reaction of 200 pounds per cubic inch may be used when designing a mat foundation supported on compacted fill.

A one-third increase in the bearing value may be used for wind or seismic loads. Since the recommended bearing value is a net value, the weight of the concrete in the footings may be taken as equal to 50 pounds per cubic foot, and the weight of the soil backfill may be neglected.

6.2.2 Settlement

If the footings are supported on non-expansive fill that is compacted in accordance with this report, the total settlement is estimated to be within acceptable limits for the proposed improvements.

6.2.3 Lateral Loads

Lateral loads may be resisted by friction and by the passive resistance of the non-expansive compacted fill soils beneath the footings. A coefficient of friction of 0.40 may be used between the foundations and the supporting materials. The passive resistance of the compacted fill soils may be assumed to be equal to the pressure developed by an equivalent fluid with a density of 350 pounds per cubic foot. The frictional resistance and the passive resistance of the materials may be combined without reduction in determining the total lateral resistance.

6.2.4 Footing Observation

To verify that footings are supported in accordance with our recommendations, all foundation excavations should be observed by a qualified geotechnical firm. Foundations should be deepened if necessary to reach satisfactory bearing materials. Any unsuitable materials including, undocumented fill, organic, loose or disturbed natural materials should be removed prior to placement of any steel or concrete.

All applicable requirements of the local governing bodies, the Occupational Safety and Health Act of 1970, and the Construction Safety Act should be met. Inspection of footing excavations may be required by the appropriate reviewing governmental agencies. The contractor should familiarize himself with the inspection requirements of the reviewing agencies.

6.2.5 Backfill

All required fill around the foundations and all utility trench backfill should be mechanically compacted in layers, not more than 8 inches in loose thickness; flooding should not be permitted. Backfill should be moisture-conditioned to a minimum 2% over the optimum moisture content and be compacted to at least 90% of the maximum density obtainable by ASTM Designation D1557-12 method of compaction. The exterior grades should be graded to drain away from the structures in order to reduce ponding of water adjacent to structures.

Compaction of the backfill as recommended in this report will be necessary to reduce settlement of the backfill and consequent settlement of the overlying improvements and buried utilities. Even at 90% compaction (ASTM D1557-12), some settlement of the backfill may be anticipated. Accordingly, any utilities supported therein should be designed to accept differential settlement, particularly at connection points to the structure.

In order to reduce the amount of backfill required, the foundations may be cut neat and poured against the excavated fill soils.

6.3 EXCAVATION

Temporary unshored vertical excavations less than 5 feet in height may be excavated without shoring. Where the necessary space is available, temporary unshored excavations may be sloped back in lieu of using shoring. Temporary unshored excavations may be sloped back at 1:1 (horizontal to vertical). The exposed excavations should be observed by a competent geotechnical firm so that modifications of the excavation criteria may be made if necessary. All applicable requirements of the local governments, the Occupational Safety and Health Act of 1970, and the Construction Safety Act should be met. Conventional earth moving/excavation equipment may be used to excavate the on-site materials.

6.4 GRADING

6.4.1 General

According to the available information, the site was graded by cutting and filling into the previously existing topography. At the boring locations, the fill soils consist of medium dense to dense silty sand with abundant gravel and cobbles.

To provide more uniform support, we recommend that the on-site soils be overexcavated and replaced as compacted fill soils. Overexcavation and replacement should extend to at least 3 feet below the bottom of the bowl features and at least 5 feet beyond the edge of the bowl. Compacted fill should be placed within a 1 to 1 plane (active wedge) extending from the bottom of the excavation. A schematic representation of the recommended excavation is presented in Figure 1, Bowl Excavation.

Footings should be underlain by at least 2 feet of compacted fill. The removal should extend at least 5 feet beyond the edge of footings. A minimum of 2 feet of compacted fill are recommended beneath pavements, slabs and sidewalks.

To reduce moisture infiltration beneath the proposed features, site drainage should be provided. Finished grades should be sloped to drain away from the structures.

6.4.2 Site Preparation and Compaction

Prior to placement of any new fill, the existing fill soils should be overexcavated to a minimum depth of 3 feet below the bottom of the proposed bowls. Removal in other areas should extend to a minimum depth of 2 feet beneath the proposed finished subgrade. Prior to fill placement, the exposed materials should be proof-rolled to disclose any soft and/or yielding areas. Any soft and/or yielding areas or expansive soils should be removed and replaced with non-expansive compacted fill. After removal of unsuitable materials, the exposed soils should be scarified to a depth of 8 inches, moisture conditioned and compacted to at least 90% of the maximum dry density (ASTM D1557-12).

After removal of unsuitable materials, all required non-expansive fill should be placed in loose lifts not more than 8 inches thick. Any new fill should be compacted to at least 90% of the maximum dry density (ASTM D1557-12). The moisture content of the imported non-expansive soils should be maintained within 2% of optimum moisture content during compaction.

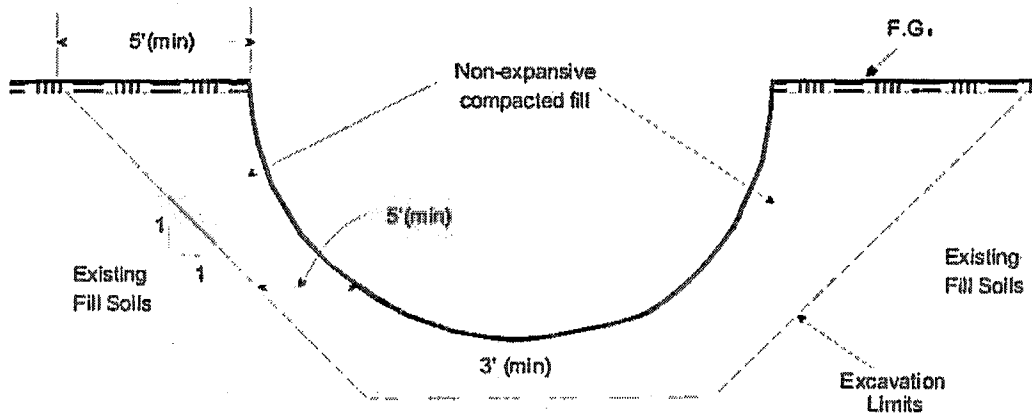


Figure 1, Bowl Excavation

The use of geogrid layers and/or a gravel layer at least 12 inches in thickness may be required if loose and/or unconsolidated materials are encountered at the bottom of the excavations beneath the bowls. A qualified geotechnical firm should observe the exposed materials to verify the complete removal of unsuitable deposits.

6.4.3 Material for Fill

The on-site soils have a very low expansion potential. These soils less any debris, organic matter, contaminated soils, and rocks greater than 6 inches in maximum dimension may be used in the required fills. Expansive clayey soils (Expansion Index greater than 21) should not be used as fill beneath structures, pavements or hardscaped areas.

If required, imported fill soils should consist of relatively non-expansive soils with an Expansion Index of less than 21, an angle of internal friction of at least 33°, and a minimum R-value of 50. The material should contain sufficient fines (binder material) to result in a stable subgrade.

6.4.4 Grading Observation

The reworking of the upper soils and the compaction of all required fill should be observed and tested by a qualified geotechnical engineering firm. Imported fill material should be approved prior to use as fill. Modifications to the grading recommendations may be required.

6.5 SEISMIC DESIGN PARAMETERS

The materials beneath the site consist of medium dense to dense silty sand. Based on the results of the field explorations and geologic evaluation, stiff soil classification "D" was assigned to the site. The coordinates of the proposed park are N32.7445° and W117.1107°.

The design of the proposed structures should be performed in accordance with the codes and regulations appropriate to the project. As such we are providing the seismic design parameters in accordance with the 2012 International Building Code (IBC).

In accordance with Section 1613 of the 2012 IBC Guidelines for New Buildings and Other Structures, the following design parameters may be used for design of the proposed improvements.

$S_s = 104\% g$ Maximum Considered Ground Motion for 0.2 second Spectral Response Acceleration, 5% of Critical Damping, Site Class B

$S_1 = 39\% g$ Maximum Considered Ground Motion for 1.0 second Spectral Response Acceleration, 5% of Critical Damping, Site Class B

The following spectral acceleration factors may be used to develop the response spectra for the deterministic Maximum Considered Earthquake.

$$F_a = 1.08$$

$$F_v = 1.6$$

$$S_{ms} = F_a S_s$$

$$S_{m1} = F_v S_1$$

6.6 WALLS BELOW GRADE

6.6.1 Lateral Pressures

Backfill materials for all walls below grade should consist of non-expansive fill soil as defined in the grading section. Compacted fill should be placed within active wedge defined as a 1 to 1 plane extending upwards from the bottom of the wall or footing. A minimum compacted fill thickness of 5 feet is recommended on all sides of the structure as noted in Figure 1.

For design of cantilevered retaining walls with heights of 15 feet or less, where the backfill consists of non-expansive granular materials and the surface of backfill is level and well drained, it may be assumed that the non-expansive soils will exert lateral pressures equal to that developed by a fluid with a density of 35 pounds per cubic foot. Where wall rotation or movement is not acceptable, we recommend that the walls below grade be designed for "at rest" pressures. When considering "at rest" pressures where the surface of the retained earth is level it may be assumed that the soils will exert an equivalent fluid pressure of 55 pounds per cubic foot.

In addition to the recommended earth pressure, the upper 10 feet of the below grade walls adjacent to roads should be designed to resist a uniform lateral pressure of 100 pounds per square foot. If all traffic is kept back at least 10 feet from the edge of the walls, the traffic surcharge may be neglected.

6.6.2 Backfill

All required backfill should be mechanically compacted in layers not more than 8 inches in loose thickness; flooding should not be permitted. Compaction of the backfill as recommended will be necessary to reduce settlement of the backfill and of overlying slabs, walks, and paving and to reduce infiltration of surface water into the backfill. The backfill should be compacted to at least 90% of the maximum density obtainable by the ASTM Designation D1557-12 method of compaction.

6.6.3 Drainage

If the backfill is placed and compacted as recommended and good surface drainage is provided, infiltration of water into the backfill adjacent to the proposed walls below grade and retaining walls should be small. To reduce the potential for water entrapment, surface and subsurface drains behind all walls are recommended.

Weep holes, backdrains, or other drainage measures should be provided in retaining walls and walls below grade to reduce the potential for entrapment of water in the backfill behind the walls. Adequate drainage of adjacent planters should be provided to prevent water infiltration into wall backfills. Drainage could consist of vertical gravel drains about 12 inches wide connected to a 4-inch-diameter perforated pipe. The perforated pipe should be surrounded by at least 1 foot of filter gravel (or uniformly graded gravel or Class II permeable material) wrapped in a geosynthetic filter fabric, such as Mirafi 140 N.S. The drain pipe should be located near the base of the wall and should discharge in a controlled manner away from the proposed structures. As an alternative to the vertical gravel drains, a drainage geocomposite such as Miradrain may be used.

6.7 SLOPES AND EROSION CONTROL

Minor slopes may be constructed to accommodate the skating features. To reduce the potential for erosion of the proposed slope faces, permanent erosion control and drainage devices should be provided as soon as feasible after grading. Slope erosion, including sloughing, riling and slumping of surface soils may be anticipated if the slopes are left unprotected for a long period of time, especially during the rainy season. Erosion control may include, but may not be limited to: erosion resistant vegetation and/or erosion control geofabrics. Slopes should be planted with appropriate drought-resistant vegetation as recommended by a landscape architect. Slopes should not be over-irrigated.

Drainage devices designed to carry surface water from overlying areas should not be blocked or destroyed, and should be maintained regularly. Water should be prevented from ponding in pad areas, or from overtopping and flowing down graded or natural slopes. Concrete drainage swales should be installed at a minimum at the top of the slopes to prevent surface runoff over the top of the slope and to reduce the erosion at the face and toe of the slope.

Animal burrows can serve to collect normal sheet flow on slopes and cause rapid and destructive erosion, and should be controlled or eliminated.

6.8 CONCRETE FLATWORK

A minimum thickness of 4 inches is recommended for all concrete walks and slabs. Flatwork reinforcement should consist of a minimum No. 3 bars with an 18-inch spacing in both directions and placed at slab mid-height. Final reinforcement configuration should be provided by the structural engineer. All concrete slabs should be underlain by at least 2 feet of non-expansive compacted fill soils. A minimum 28-day concrete compressive strength of 2,500 pounds per square inch is recommended for pedestrian sidewalks and other non-traffic hardscaped areas.

Weakened plane joints should be placed in sidewalks at intervals that are no greater than 15 feet on center. Weakened plane joints should be at least 1-inch deep. Full depth construction joints should be placed at 45 feet intervals. Rectangular patio areas should have weakened plane joints at 10 feet on center in both directions. Expansion joint material should be placed adjacent to any vertical surfaces (walls, buildings or columns).

6.9 PAVING

Tests performed on a sample of the on-site soils indicated an R-value of 55. The test results are presented in the Appendix.

To provide support for paving, the subgrade soils should be prepared as recommended in the previous sections on Grading. Compaction of the subgrade to at least 90%, including trench backfills, will be important for paving support.

For purposes of pavement design, it was assumed that the on-site soils compacted as recommended in this report, will be used as the supporting subgrade. The pavement thickness should be confirmed prior to construction so that any required modifications may be made based on the actual fill materials to be used.

A Traffic Index of 5 was assumed for design of the proposed pavements. The assumed traffic includes automobile and light truck traffic such as the maintenance trucks. If heavy trucks, such as fire trucks are anticipated the pavement sections should be revised to include the heavier loads.

In completing the design we have assumed that the portland cement concrete (p.c.c.) pavement will have a 28-day flexural strength of 650 pounds per square inch or a compressive strength of at least 4,000 pounds per square inch. Our design also assumes that the on-site materials or imported materials with a minimum R-value of 55, with an equivalent Modulus of Subgrade Reaction (k) of 200 pounds per cubic inch will be used for support.

Table 2, Portland Cement Concrete Pavement

Traffic Index	Subgrade	Paving Section*
5 (Automobile and light truck traffic)	Non-expansive compacted fill	6½" p.c.c

*City of San Diego Standard Drawings

7.0 SOIL CORROSIVITY

Based on the laboratory test results, the on-site soils have low sulfate ion concentrations (140 parts per million (ppm) and low concentrations of chloride ions (70 ppm). The test results are presented on Plate A-8, Corrosion Test Data. Therefore Type I, II or V cement may be used during construction. Concrete should be thoroughly vibrated. Laboratory tests show a moderate to severe resistivity value (2,000 ohm-cm), indicating a severe potential for metal loss due to electrochemical corrosion processes. Therefore, a minimum concrete cover of 3 inches should be provided over all re-bar, anchor bolts or metallic embeds placed within the foundations and to 18 inches above the ground surface. Reinforcing steel should be protected with a concrete cover of at least 1½ inches for formed surfaces not exposed to weather or not in contact with the ground. If the minimum cover is not achieved corrosion protection of steel members such as epoxy or asphalt coatings may be used. We recommend that a corrosion engineer be consulted for final corrosion protection recommendations.

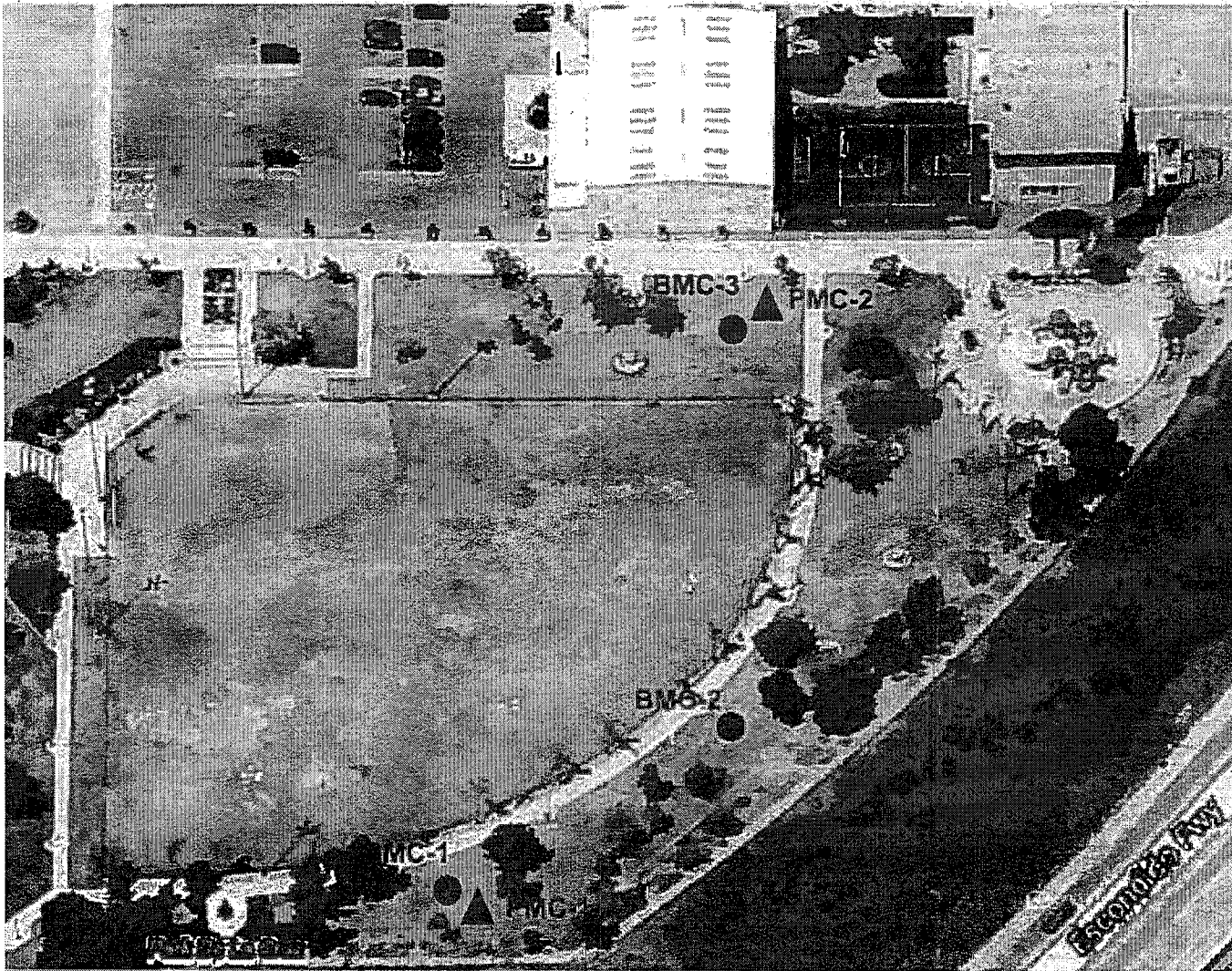
8.0 BASIS FOR RECOMMENDATIONS

The recommendations provided in this report are based on our understanding of the described project information and on our interpretation of the data collected during the subsurface exploration. We have made our recommendations based on experience with similar subsurface conditions under similar loading conditions. The recommendations apply to the specific project discussed in this report; therefore, any change in the facility loads, expected traffic conditions, facility location, or site grades shall be provided to us so we may review our conclusions and recommendations and make any necessary modifications.

We request an opportunity to review the final construction documents and specifications for the proposed facility to verify that the recommendations presented are incorporated into the final design. The recommendations provided in this report are also based on the assumption that the necessary geotechnical observations and testing during construction will be performed by representatives of our firm. The field observation services are considered a continuation of the geotechnical investigation and essential to verify that the actual soil conditions are as anticipated. This also provides for the procedure whereby the Client can be advised of unanticipated or changed conditions that would require modifications of our original recommendations. In addition, the presence of our representatives at the site provides the Client with an independent professional opinion regarding the geotechnical related construction procedures. If another firm is retained for the geotechnical observation services, our professional responsibility and liability would be reduced to the extent that we are no longer the engineer of record.

SITE PLAN

PROPOSED MID CITY SKATE PARK DE LA CRUZ COMMUNITY PARK SAN DIEGO, CALIFORNIA



(SCALE 1" = 100')

KEY:

- BMC-3 ● Approximate Boring Location and Number
- PMC-1 ▲ Approximate Percolation Location and Number

**APPENDIX A
FIELD EXPLORATIONS AND LABORATORY TESTS**

**APPENDIX A
FIELD EXPLORATIONS AND LABORATORY TESTS**

FIELD EXPLORATIONS

The soil conditions were explored by drilling three borings and two percolation test holes at the locations shown on Plate 1. The borings and test holes were drilled to depths of 3 to 14 feet using 8-inch diameter hollow-stem auger drilling equipment. After completion of excavation, the exploratory excavations were backfilled using the excavated soils.

The soils encountered were logged by our field engineer/geologist, who obtained bulk samples for laboratory observation and testing. A California-modified sampler was used to retrieve relatively undisturbed samples. This sampler consisted of a brass-ring-lined split-tube with an inside diameter of 2-1/2 inches and an outside diameter of 3 inches. The hammer used to drive the sampler weighed 140 pounds, and a drop of about 30 inches was used. The number of blows required to drive the sampler 12 inches is indicated on the logs. The logs of the borings are presented on Plates A-1.1 through A-1.3; the depths at which relatively undisturbed samples were obtained are indicated to the left of the logs.

The soils are classified in accordance with the Unified Soil Classification System described on Plate A-2.

LABORATORY TESTS

The field moisture content and dry density of the soils encountered were determined by performing tests on the relatively undisturbed samples. The results of the tests are shown to the left of the boring logs.

Direct shear tests were performed on remolded samples compacted to 90% of the maximum dry density at near optimum moisture content. The tests were performed at various surcharge pressures

after saturation. The yield point values determined from the direct shear tests are presented on Plate A-3, Direct Shear Test Data.

The optimum moisture content and maximum dry density of the soils were determined by performing a compaction test in accordance with ASTM D1557 method. The results of the test are presented on Plate A-4, Compaction Test Data.

To provide information for paving design, a Stabilometer (R-value) test was performed on a sample of the on-site soils. The test was performed in accordance with Standard 301 of the State of California Department of Transportation. The test results are presented on Plate A-5, R-Value Test Data.

The Expansion Index of the on-site soils was determined by testing one sample in accordance with ASTM D4829. The test results are shown on Plate A-6, Expansion Index Test Data.

To determine the particle size distribution of the soils as an aid in classifying the soils, mechanical analyses were performed on two samples in accordance with ASTM Test Method D422. The results of the mechanical analyses are presented on Plates A-7.1 and A-7.2, Particle Size Distribution.

To evaluate the corrosion potential of the on-site soils, one soil sample was tested at an analytical laboratory for pH, resistivity, sulfate and chloride content in accordance with the following standards.

Resistivity and pH – California Test 643
Soluble Chlorides – California Test 417
Soluble Sulfates – California Test 422

The test results are presented on Plate A-8, Corrosivity Test Data.

Note: The log of subsurface conditions shown hereon applies only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

ELEVATION (ft.)	DEPTH (ft.)	PID READINGS (ppm)	MOISTURE (% of dry wt.)	DRY DENSITY (lbs./cu. ft.)	BLOWS/FOOT	SAMPLE LOC.
	5				64	
	10				100	
	10				100	
	15					
	20					
	25					
	30					
	35					
	40					

BORING BMC-1

DATE DRILLED: 10/28/2014
 EQUIPMENT USED: 8-inch Diameter Hollow-stem-auger

LAT 32.7443 LONG -117.1110



FILL - SILTY SAND - fine to medium, medium dense to dense moist, some gravel and pieces of concrete, brown and light brown
 Abundant gravel and cobbles
 <SLOW DRILLING>

Very dense

<SLOW DRILLING>

<BORING TERMINATED AT A DEPTH OF 14 FEET DUE TO REFUSAL IN THE GRAVEL AND COBBLES>

NOTES: Groundwater not encountered. Boring backfilled with soil cuttings and bentonite chips.

LOG OF BORING



Note: The log of subsurface conditions shown hereon applies only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

ELEVATION (ft.)	DEPTH (ft.)	PID READINGS (ppm)	MOISTURE (% of dry wt.)	DRY DENSITY (lbs./cu. ft.)	BLOWS/FOOT	SAMPLE LOC.
	5					
	10					
	15					
	20					
	25					
	30					
	35					
	40					

BORING BMC-2

DATE DRILLED: 10/28/2014

EQUIPMENT USED: 8-inch Diameter Hollow-stem-auger

LAT 32.7445 LONG -117.1107



SM

FILL - SILTY SAND - fine to medium, medium dense to dense, moist, some gravel and cobbles, light brown

Abundant gravel and cobbles
< SLOW DRILLING >

< BORING TERMINATED AT A DEPTH OF 5 FEET DUE TO REFUSAL IN THE GRAVEL AND COBBLES >

NOTES: Groundwater not encountered. Boring backfilled with soil cuttings and bentonite chips.

LOG OF BORING



Note: The log of subsurface conditions shown hereon applies only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

ELEVATION (ft.)	DEPTH (ft.)	PID READINGS (ppm)	MOISTURE (% of dry wt.)	DRY DENSITY (lbs./cu. ft.)	BLOWS/FOOT	SAMPLE LOC.
	5		7.9		60 100 38	SM
	10					SM
	15					
	20					
	25					
	30					
	35					
	40					

BORING BMC-3

DATE DRILLED: 10/28/2014
EQUIPMENT USED: 8-inch Diameter Hollow-stem-auger

LAT 32.7453 LONG -117.1106



FILL - SILTY SAND - fine to medium, medium dense, moist, brown to light brown

< SLOW DRILLING. ABUNDANT GRAVEL AND COBBLES. BORING MOVED 2 FEET SOUTH >
Light brown
Medium dense

SILTY SAND - fine to medium, dense to very dense, moist, dark brown and dark grey
Brown, abundant gravel and cobbles

< BORING TERMINATED AT A DEPTH OF 9-1/2 FEET DUE TO REFUSAL IN THE GRAVEL AND COBBLES >

NOTES: Groundwater not encountered. Boring backfilled with soil cuttings and bentonite chips.

LOG OF BORING



MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS (More than 50% of material is LARGER than No. 20 sieve size)	GRAVELS (More than 50% of coarse fraction is LARGER than the No. 4 sieve size)	CLEAN GRAVELS (Little or no fines)	GW	Well graded gravels or gravel - sand mixtures, little or no fines.
			GP	Poorly graded gravels or gravel - sand mixtures, little or no fines.
		GRAVELS WITH FINES (Appreciable amount of fines)	GM	Silty gravels, gravel - sand - silt mixtures.
			GC	Clayey gravels, gravel - sand - clay mixtures.
	SANDS (More than 50% of coarse fraction is SMALLER than the No. 4 sieve size)	CLEAN SANDS (Little or no fines)	SW	Well graded sands, gravelly sands, little or no fines.
			SP	Poorly graded sands, gravelly sands, little or no fines.
		SANDS WITH FINES (Appreciable amount of fines)	SM	Silty sands, sand - silt mixtures.
			SC	Clayey sands, sand - clay mixtures.
FINE GRAINED SOILS (More than 50% of material is SMALLER than No. 200 sieve size)	SILTS AND CLAYS (Liquid limit LESS than 50)	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.	
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.	
		OL	Organic silts and organic silty clays of low plasticity.	
	SILTS AND CLAYS (Liquid limit GREATER than 50)	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.	
		CH	Inorganic clays of high plasticity, fat clays.	
		OH	Organic clays of medium to high plasticity, organic silts.	
		Pt	Peat and other highly organic soils.	
HIGHLY ORGANIC SOILS				







BOUNDARY CLASSIFICATIONS: Soils possessing characteristics of two groups are designated by combinations of group symbols.

PARTICLE SIZE LIMITS

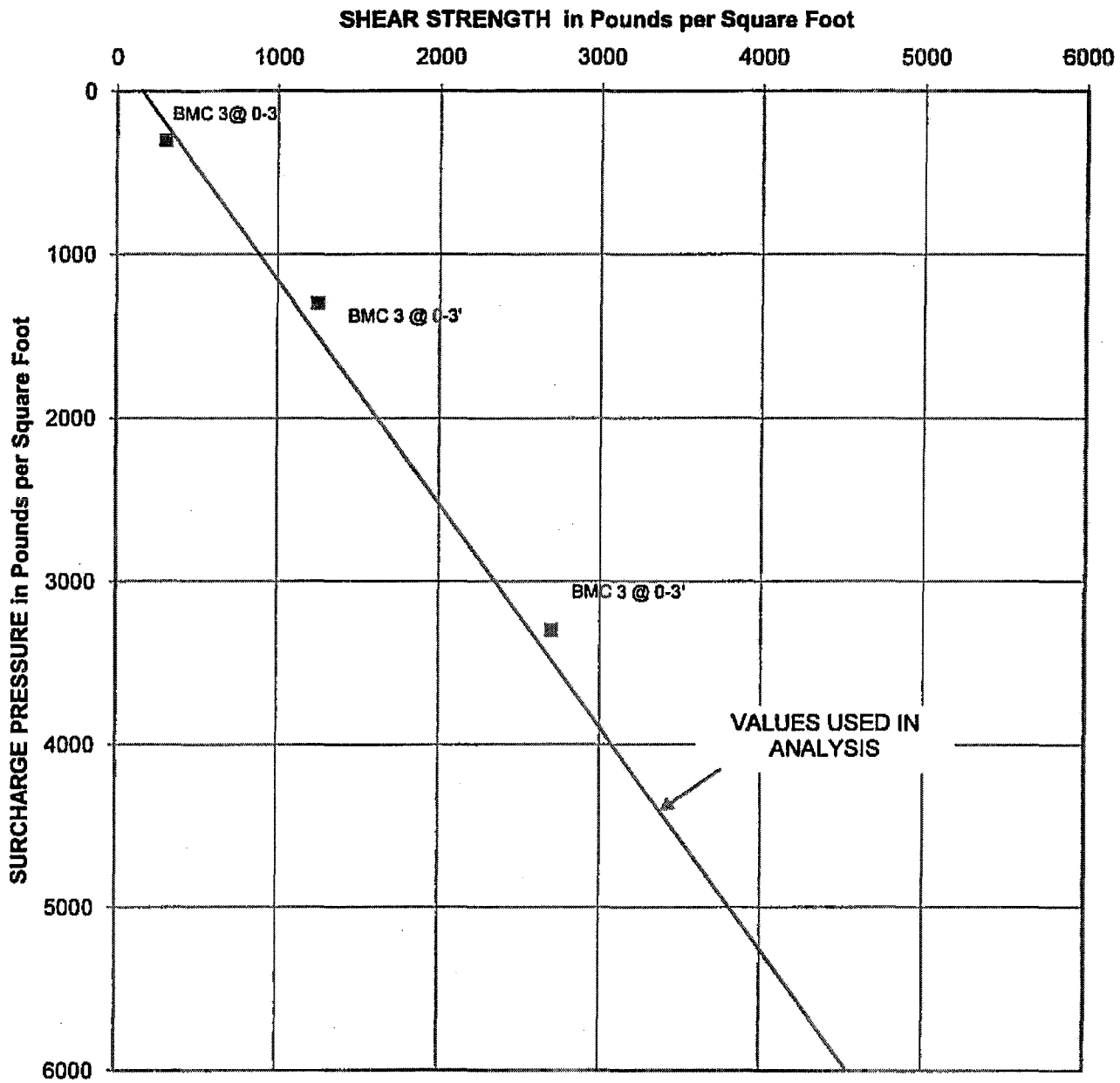
SILT OR CLAY	SAND			GRAVEL		COBBLES	BOULDERS
	Fine	Medium	Coarse	Fine	Coarse		
	No. 200	No. 40	No. 10	No. 4	3/4"	3"	12"

US STANDARD SIEVE SIZE

Key:

-  California Sampler
-  Standard Penetration
-  No Recovery
-  Continuous Auger Coring
-  HQ Coring
-  Bulk or Chunk Sample





KEY:

- Remolded samples (On-site soils: Compacted to 90%)
- All samples tested after saturation

SHEAR SUMMARY

BORING NUMBER AND
SAMPLE DEPTH

BMC 3 @ 0 - 3'

SOIL TYPE

FILL - SILTY SAND
w/Gravel

MAXIMUM DRY DENSITY
(lbs per cubic foot)

127

OPTIMUM MOISTURE
CONTENT
(% of dry weight)

10.5

COMPACTION TEST DATA

(ASTM D1557)

**BORING NUMBER AND
SAMPLE DEPTH**

BMC 2 @ 0 - 2

SOIL TYPE

FILL - SILTY SAND w/Gravel

R-VALUE

by Exudation	55
by Expansion	---
at Equilibrium	55

R-VALUE TEST DATA

**BORING NUMBER AND
SAMPLE DEPTH**

BMC 2 @ 0 - 2'

SOIL TYPE

**FILL - SILTY SAND
w/Gravel**

**FINAL MOISTURE
CONTENT**

23.3

**DRY DENSITY
(in pounds per cubic foot)**

110

EXPANSION INDEX

—

EXPANSION POTENTIAL

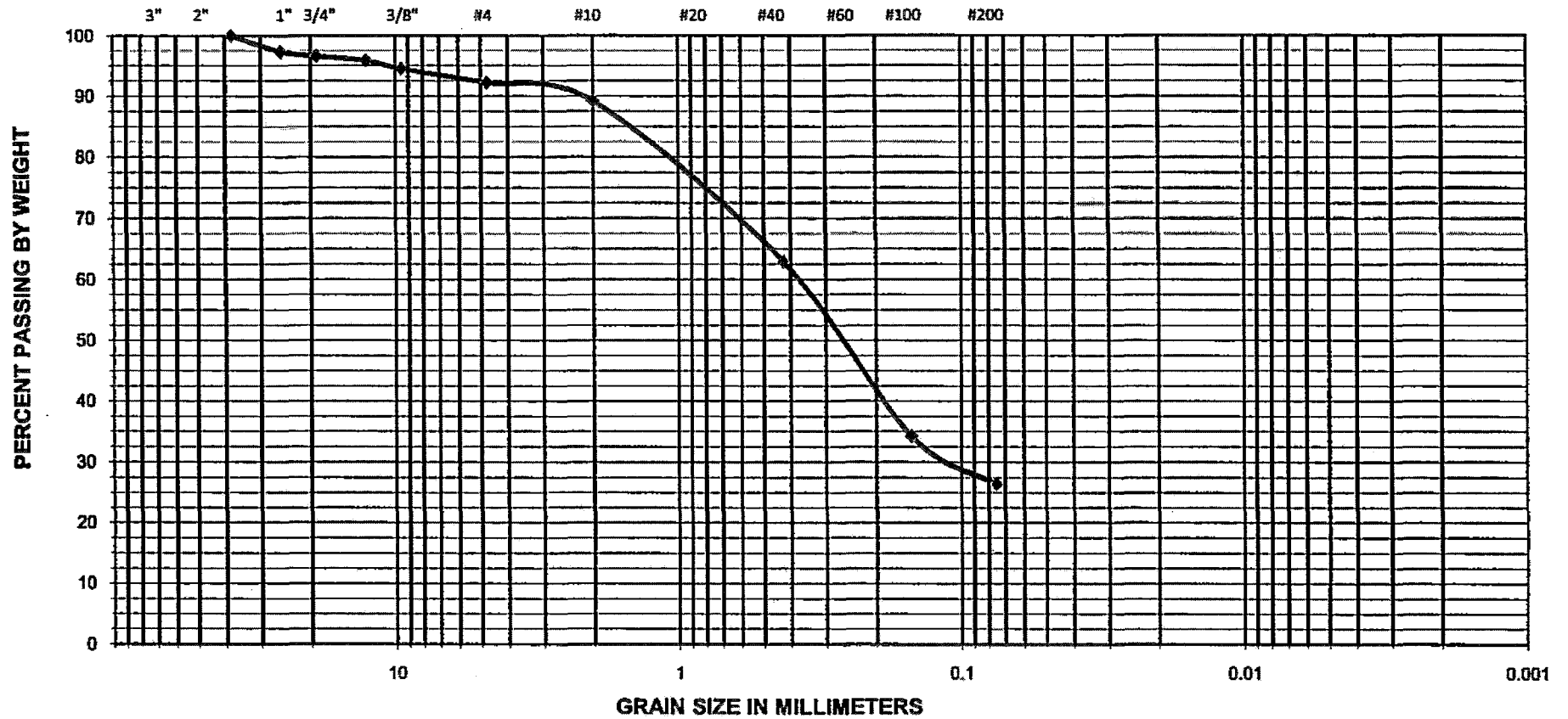
VERY LOW

**EXPANSION INDEX TEST DATA
(ASTM D4829)**

UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT AND CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	HYDROMETER

US STANDARD SIEVE SIZES



PARTICLE SIZE DISTRIBUTION

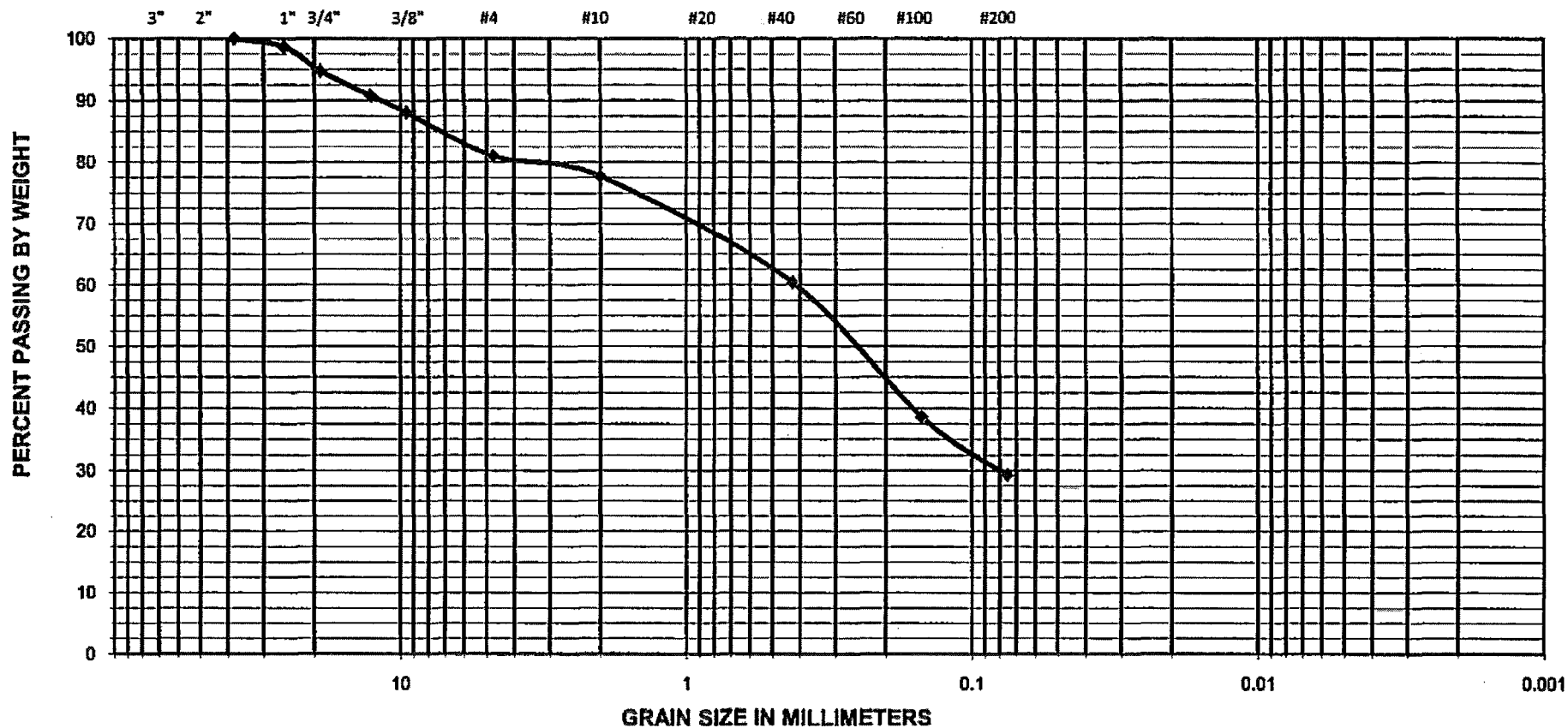
BORING	BMC-2	SOIL TYPE
DEPTH	0 - 2'	SILTY SAND w/Gravel
Job No.	G2014015-1	



UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT AND CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	HYDROMETER

US STANDARD SIEVE SIZES



PARTICLE SIZE DISTRIBUTION

BORING	BMC-3	SOIL TYPE
DEPTH	0 - 3'	SILTY SAND w/Gravel
Job No.	G2014015-1	



**BORING NUMBER
AND SAMPLE DEPTH**

BMC 1 @ 0 - 2'

Caltrans Method

SOIL TYPE

**FILL - SILTY SAND
w/Gravel**

pH	8.8	643
Resistivity (in ohms-cm)	2,000	643
Soluble Sulfate (%)	0.014	417
Soluble Chloride (%)	0.007	422

CORROSIVITY TEST DATA



Appendix F

Hydraulic Calculations

PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE
 (Reference: LACFCD, LACRD, AND OCEMA HYDRAULICS CRITERION)
 (c) Copyright 1982-2012 Advanced Engineering Software (aes)
 Ver. 19.0 Release Date: 06/01/2012 License ID 1423

Analysis prepared by:

O'Day Consultants
 2710 Loker Ave. West Ste 100
 Carlsbad, CA 92010
 (760) 931-7700

***** DESCRIPTION OF STUDY *****
 * HYDRAULIC CALCULATIONS FOR STORM DRAIN LINE 7- BASIN C1A *
 * PARK DE LA CRUZ CALCS BY NF *
 * 9/10/2015 *

FILE NAME: MIDC1.DAT
 TIME/DATE OF STUDY: 11:06 09/11/2015

GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
 NODAL POINT STATUS TABLE
 (Note: "*" indicates nodal point data used.)

NODE NUMBER	MODEL PROCESS	UPSTREAM RUN		DOWNSTREAM RUN	
		PRESSURE HEAD (FT)	PRESSURE+ MOMENTUM (POUNDS)	FLOW DEPTH (FT)	PRESSURE+ MOMENTUM (POUNDS)
2000.00-	} FRICTION	0.56 Dc	17.17	0.52*	17.30
2001.00-		0.56*Dc	17.17	0.56*Dc	17.17

 MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE = 25

NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST CONSERVATIVE FORMULAE FROM THE CURRENT LACRD, LACFCD, AND OCEMA DESIGN MANUALS.

DOWNSTREAM PIPE FLOW CONTROL DATA:

NODE NUMBER = 2000.00 FLOWLINE ELEVATION = 321.43
 PIPE FLOW = 1.40 CFS PIPE DIAMETER = 8.00 INCHES
 ASSUMED DOWNSTREAM CONTROL HGL = 321.430 FEET
 *NOTE: ASSUMED DOWNSTREAM CONTROL DEPTH(0.00 FT.)
 IS LESS THAN CRITICAL DEPTH(0.56 FT.)
 ==> CRITICAL DEPTH IS ASSUMED AS DOWNSTREAM CONTROL DEPTH
 FOR UPSTREAM RUN ANALYSIS

 NODE 2000.00 : HGL = < 321.947>; EGL = < 322.308>; FLOWLINE = < 321.430>

FLOW PROCESS FROM NODE 2000.00 TO NODE 2001.00 IS CODE = 1

UPSTREAM NODE 2001.00 ELEVATION = 322.50 (FLOW IS SUPERCRITICAL)

 CALCULATE FRICTION LOSSES (LACFCD):

PIPE FLOW = 1.40 CFS PIPE DIAMETER = 8.00 INCHES
 PIPE LENGTH = 71.19 FEET MANNING'S N = 0.01300

 NORMAL DEPTH (FT) = 0.52 CRITICAL DEPTH (FT) = 0.56
 =====

UPSTREAM CONTROL ASSUMED FLOWDEPTH (FT) = 0.56
 =====

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL (FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY (FT)	PRESSURE+ MOMENTUM (POUNDS)
0.000	0.556	4.497	0.871	17.17
0.006	0.555	4.508	0.871	17.17
0.023	0.553	4.520	0.871	17.17
0.052	0.552	4.532	0.871	17.17
0.096	0.550	4.544	0.871	17.17
0.154	0.548	4.556	0.871	17.17
0.229	0.547	4.568	0.871	17.18
0.321	0.545	4.580	0.871	17.18
0.434	0.544	4.593	0.871	17.18
0.568	0.542	4.606	0.871	17.19
0.728	0.540	4.618	0.872	17.19
0.916	0.539	4.631	0.872	17.19
1.137	0.537	4.644	0.872	17.20
1.395	0.535	4.657	0.873	17.20
1.697	0.534	4.671	0.873	17.21
2.051	0.532	4.684	0.873	17.22
2.469	0.531	4.698	0.874	17.22
2.964	0.529	4.711	0.874	17.23
3.558	0.527	4.725	0.874	17.24
4.281	0.526	4.739	0.875	17.25
5.180	0.524	4.753	0.875	17.26
6.333	0.523	4.768	0.876	17.27
7.889	0.521	4.782	0.876	17.27
10.178	0.519	4.797	0.877	17.29
14.267	0.518	4.811	0.877	17.30
71.190	0.517	4.815	0.878	17.30

 NODE 2001.00 : HGL = < 323.056>; EGL = < 323.371>; FLOWLINE = < 322.500>

UPSTREAM PIPE FLOW CONTROL DATA:

NODE NUMBER = 2001.00 FLOWLINE ELEVATION = 322.50
 ASSUMED UPSTREAM CONTROL HGL = 323.06 FOR DOWNSTREAM RUN ANALYSIS

=====

END OF GRADUALLY VARIED FLOW ANALYSIS

PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE
 (Reference: LACFCD, LACRD, AND OCEMA HYDRAULICS CRITERION)
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***** DESCRIPTION OF STUDY *****
 * HYDRAULIC CALCULATIONS FOR STORM DRAIN LINE 20- BASIN C3E *
 * PARK DE LA CRUZ BY NF *
 * 10/20/2015 *

FILE NAME: MIDC3E.DAT
 TIME/DATE OF STUDY: 10:29 10/20/2015

GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
 NODAL POINT STATUS TABLE

(Note: "*" indicates nodal point data used.)

NODE NUMBER	MODEL PROCESS	UPSTREAM RUN		DOWNSTREAM RUN	
		PRESSURE HEAD (FT)	PRESSURE+ MOMENTUM (POUNDS)	FLOW DEPTH (FT)	PRESSURE+ MOMENTUM (POUNDS)
3000.00-	) FRICTION	0.63 Dc	29.16	0.42*	36.41
3000.40-		0.63*Dc	29.16	0.63*Dc	29.16

 MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE = 25

NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
 CONSERVATIVE FORMULAE FROM THE CURRENT LACRD, LACFCD, AND OCEMA
 DESIGN MANUALS.

DOWNSTREAM PIPE FLOW CONTROL DATA:

NODE NUMBER = 3000.00 FLOWLINE ELEVATION = 315.60
 PIPE FLOW = 2.00 CFS PIPE DIAMETER = 8.00 INCHES
 ASSUMED DOWNSTREAM CONTROL HGL = 315.600 FEET

*NOTE: ASSUMED DOWNSTREAM CONTROL DEPTH(0.00 FT.)
 IS LESS THAN CRITICAL DEPTH(0.63 FT.)

==> CRITICAL DEPTH IS ASSUMED AS DOWNSTREAM CONTROL DEPTH
 FOR UPSTREAM RUN ANALYSIS

 NODE 3000.00 : HGL = < 316.016>; EGL = < 317.199>; FLOWLINE = < 315.600>

FLOW PROCESS FROM NODE 3000.00 TO NODE 3000.40 IS CODE = 1
 UPSTREAM NODE 3000.40 ELEVATION = 316.89 (FLOW IS SUPERCRITICAL)

 CALCULATE FRICTION LOSSES (LACFCD):

PIPE FLOW = 2.00 CFS PIPE DIAMETER = 8.00 INCHES
 PIPE LENGTH = 20.02 FEET MANNING'S N = 0.01300

NORMAL DEPTH (FT) = 0.39 CRITICAL DEPTH (FT) = 0.63
 =====

UPSTREAM CONTROL ASSUMED FLOWDEPTH (FT) = 0.63
 =====

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL (FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY (FT)	PRESSURE+ MOMENTUM (POUNDS)
0.000	0.626	5.873	1.162	29.16
0.015	0.617	5.928	1.163	29.18
0.061	0.608	5.988	1.165	29.21
0.137	0.598	6.055	1.168	29.28
0.245	0.589	6.127	1.172	29.37
0.387	0.580	6.205	1.178	29.48
0.564	0.570	6.289	1.185	29.62
0.780	0.561	6.379	1.193	29.78
1.038	0.551	6.475	1.203	29.97
1.344	0.542	6.577	1.214	30.19
1.704	0.533	6.686	1.227	30.43
2.124	0.523	6.801	1.242	30.71
2.614	0.514	6.923	1.259	31.01
3.185	0.505	7.052	1.277	31.35
3.851	0.495	7.189	1.298	31.71
4.632	0.486	7.335	1.322	32.11
5.552	0.477	7.488	1.348	32.55
6.646	0.467	7.651	1.377	33.03
7.960	0.458	7.823	1.409	33.55
9.566	0.448	8.006	1.444	34.11
11.570	0.439	8.199	1.484	34.71
14.157	0.430	8.404	1.527	35.37
17.668	0.420	8.622	1.575	36.07
20.020	0.416	8.724	1.599	36.41

 NODE 3000.40 : HGL = < 317.516>;EGL= < 318.052>;FLOWLINE= < 316.890>

UPSTREAM PIPE FLOW CONTROL DATA:

NODE NUMBER = 3000.40 FLOWLINE ELEVATION = 316.89
 ASSUMED UPSTREAM CONTROL HGL = 317.52 FOR DOWNSTREAM RUN ANALYSIS
 =====

END OF GRADUALLY VARIED FLOW ANALYSIS

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Analysis prepared by:

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***** DESCRIPTION OF STUDY *****
 * HYDRAULIC CALCULATIONS FOR STORM DRAIN LINE 19- BASIN C3I *
 * PARK DE LA CRUZ CALCS BY NF *
 * JN 141020 *

FILE NAME: MIDC3I.DAT
 TIME/DATE OF STUDY: 09:09 10/20/2015

GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
 NODAL POINT STATUS TABLE

(Note: "*" indicates nodal point data used.)

NODE NUMBER	MODEL PROCESS	UPSTREAM RUN		DOWNSTREAM RUN	
		PRESSURE HEAD (FT)	PRESSURE+ MOMENTUM (POUNDS)	FLOW DEPTH (FT)	PRESSURE+ MOMENTUM (POUNDS)
3006.00-	} FRICTION	0.21*Dc	1.33	0.19*Dc	1.35
3007.00-		0.21*Dc	1.33	0.21*Dc	1.33

 MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE = 25

NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
 CONSERVATIVE FORMULAE FROM THE CURRENT LACRD, LACFCD, AND OCEMA
 DESIGN MANUALS.

DOWNSTREAM PIPE FLOW CONTROL DATA:

NODE NUMBER = 3006.00 FLOWLINE ELEVATION = 316.54
 PIPE FLOW = 0.20 CFS PIPE DIAMETER = 8.00 INCHES
 ASSUMED DOWNSTREAM CONTROL HGL = 316.540 FEET

*NOTE: ASSUMED DOWNSTREAM CONTROL DEPTH(0.00 FT.)
 IS LESS THAN CRITICAL DEPTH(0.21 FT.)

====> CRITICAL DEPTH IS ASSUMED AS DOWNSTREAM CONTROL DEPTH
 FOR UPSTREAM RUN ANALYSIS

 NODE 3006.00 : HGL = < 316.727>; EGL = < 316.824>; FLOWLINE = < 316.540>

FLOW PROCESS FROM NODE 3006.00 TO NODE 3007.00 IS CODE = 1

UPSTREAM NODE 3007.00 ELEVATION = 317.33 (FLOW IS SUPERCRITICAL)

 CALCULATE FRICTION LOSSES (LACFCD):

PIPE FLOW = 0.20 CFS PIPE DIAMETER = 8.00 INCHES
 PIPE LENGTH = 85.03 FEET MANNING'S N = 0.01300

 NORMAL DEPTH (FT) = 0.19 CRITICAL DEPTH (FT) = 0.21
 =====

UPSTREAM CONTROL ASSUMED FLOWDEPTH (FT) = 0.21
 =====

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL (FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY (FT)	PRESSURE+ MOMENTUM (POUNDS)
0.000	0.206	2.186	0.280	1.33
0.002	0.205	2.197	0.280	1.33
0.008	0.204	2.208	0.280	1.33
0.018	0.203	2.220	0.280	1.33
0.033	0.203	2.231	0.280	1.33
0.053	0.202	2.242	0.280	1.33
0.078	0.201	2.254	0.280	1.33
0.110	0.200	2.265	0.280	1.33
0.150	0.200	2.277	0.280	1.33
0.196	0.199	2.289	0.280	1.33
0.252	0.198	2.301	0.280	1.33
0.318	0.197	2.313	0.280	1.34
0.396	0.197	2.325	0.281	1.34
0.488	0.196	2.337	0.281	1.34
0.595	0.195	2.350	0.281	1.34
0.721	0.194	2.362	0.281	1.34
0.870	0.194	2.375	0.281	1.34
1.048	0.193	2.388	0.281	1.34
1.261	0.192	2.400	0.282	1.34
1.522	0.191	2.413	0.282	1.34
1.847	0.191	2.426	0.282	1.34
2.265	0.190	2.440	0.282	1.35
2.831	0.189	2.453	0.283	1.35
3.666	0.188	2.467	0.283	1.35
5.161	0.188	2.480	0.283	1.35
84.840	0.187	2.494	0.284	1.35
85.030	0.187	2.494	0.284	1.35

 NODE 3007.00 : HGL = < 317.535>; EGL = < 317.610>; FLOWLINE = < 317.330>

UPSTREAM PIPE FLOW CONTROL DATA:

NODE NUMBER = 3007.00 FLOWLINE ELEVATION = 317.33
 ASSUMED UPSTREAM CONTROL HGL = 317.54 FOR DOWNSTREAM RUN ANALYSIS

=====

END OF GRADUALLY VARIED FLOW ANALYSIS

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***** DESCRIPTION OF STUDY *****
 * HYDRAULIC CALCULATIONS FOR STORM DRAIN LINE 19- BASIN C3I *
 * PARK DE LA CRUZ CALCS BY NF *
 * JN 141020 *

FILE NAME: MIDC3I.DAT
 TIME/DATE OF STUDY: 09:09 10/20/2015

GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
 NODAL POINT STATUS TABLE
 (Note: "*" indicates nodal point data used.)

NODE NUMBER	MODEL PROCESS	UPSTREAM RUN		DOWNSTREAM RUN	
		PRESSURE HEAD (FT)	PRESSURE+ MOMENTUM (POUNDS)	FLOW DEPTH (FT)	PRESSURE+ MOMENTUM (POUNDS)
3006.00-	} FRICTION	0.21*Dc	1.33	0.19*Dc	1.35
3007.00-		0.21*Dc	1.33	0.21*Dc	1.33

 MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE = 25

NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
 CONSERVATIVE FORMULAE FROM THE CURRENT LACRD, LACFCD, AND OCEMA
 DESIGN MANUALS.

DOWNSTREAM PIPE FLOW CONTROL DATA:

NODE NUMBER = 3006.00 FLOWLINE ELEVATION = 316.54
 PIPE FLOW = 0.20 CFS PIPE DIAMETER = 8.00 INCHES
 ASSUMED DOWNSTREAM CONTROL HGL = 316.540 FEET

*NOTE: ASSUMED DOWNSTREAM CONTROL DEPTH(0.00 FT.)
 IS LESS THAN CRITICAL DEPTH(0.21 FT.)

====> CRITICAL DEPTH IS ASSUMED AS DOWNSTREAM CONTROL DEPTH
 FOR UPSTREAM RUN ANALYSIS

 NODE 3006.00 : HGL = < 316.727>; EGL = < 316.824>; FLOWLINE = < 316.540>

FLOW PROCESS FROM NODE 3006.00 TO NODE 3007.00 IS CODE = 1

PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE
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***** DESCRIPTION OF STUDY *****
 * HYDRAULIC CALCULATIONS FOR STORM DRAIN LINES 8-18 PORTION OF BASIN C *
 * PARK DE LA CRUZ CALCS BY NF *
 * JN 141020 *

FILE NAME: AESC3C.DAT
 TIME/DATE OF STUDY: 11:31 10/20/2015

GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
 NODAL POINT STATUS TABLE

(Note: "*" indicates nodal point data used.)

NODE NUMBER	MODEL PROCESS	UPSTREAM RUN		DOWNSTREAM RUN	
		PRESSURE HEAD (FT)	PRESSURE+ MOMENTUM (POUNDS)	FLOW DEPTH (FT)	PRESSURE+ MOMENTUM (POUNDS)
3000.10-		0.89 Dc	76.02	0.80*	77.09
	} FRICTION				
3000.20-		0.89*Dc	76.02	0.89*Dc	76.02
	} JUNCTION				
3000.30-		1.15*	54.74	0.59 Dc	27.21
	} FRICTION		} HYDRAULIC JUMP		
3001.00-		0.59 Dc	27.21	0.43*	31.45
	} JUNCTION				
3001.10-		0.63*Dc	26.90	0.63*Dc	26.90
	} FRICTION				
3002.00-		0.71*	27.37	0.63 Dc	26.90
	} JUNCTION				
3002.10-		0.94*	24.86	0.44 Dc	10.89
	} FRICTION				
3003.00-		0.66*	14.21	0.44 Dc	10.89
	} JUNCTION				
3003.10-		0.55*	8.72	0.35 Dc	6.10
	} FRICTION				
3004.00-		0.37*Dc	6.14	0.35*Dc	6.10
	} JUNCTION				
3004.10-		0.50*	5.09	0.29 Dc	3.23
	} FRICTION				
3004.30-		0.32*	3.27	0.29 Dc	3.23
	} FRICTION				

3004.50-	0.32*	3.28	0.29 Dc	3.23
} JUNCTION				
3004.60-	0.30*	1.69	0.21 Dc	1.33
} FRICTION				
3004.70-	0.22*Dc	1.35	0.21*Dc	1.33
} FRICTION				
3004.90-	0.22*Dc	1.34	0.21*Dc	1.33

 MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE = 25

NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST CONSERVATIVE FORMULAE FROM THE CURRENT LACRD, LACFCD, AND OCEMA DESIGN MANUALS.

DOWNSTREAM PIPE FLOW CONTROL DATA:

NODE NUMBER = 3000.10 FLOWLINE ELEVATION = 314.41
 PIPE FLOW = 5.30 CFS PIPE DIAMETER = 18.00 INCHES
 ASSUMED DOWNSTREAM CONTROL HGL = 314.410 FEET

*NOTE: ASSUMED DOWNSTREAM CONTROL DEPTH(0.00 FT.)
 IS LESS THAN CRITICAL DEPTH(0.89 FT.)

====> CRITICAL DEPTH IS ASSUMED AS DOWNSTREAM CONTROL DEPTH
 FOR UPSTREAM RUN ANALYSIS

 NODE 3000.10 : HGL = < 315.215>;EGL= < 315.683>;FLOWLINE= < 314.410>

FLOW PROCESS FROM NODE 3000.10 TO NODE 3000.20 IS CODE = 1
 UPSTREAM NODE 3000.20 ELEVATION = 314.77 (FLOW IS SUPERCRITICAL)

 CALCULATE FRICTION LOSSES (LACFCD):

PIPE FLOW = 5.30 CFS PIPE DIAMETER = 18.00 INCHES
 PIPE LENGTH = 44.10 FEET MANNING'S N = 0.01300

 NORMAL DEPTH(FT) = 0.80 CRITICAL DEPTH(FT) = 0.89
 =====

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 0.89
 =====

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL (FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY (FT)	PRESSURE+ MOMENTUM (POUNDS)
0.000	0.887	4.871	1.256	76.02
0.011	0.883	4.894	1.256	76.02
0.047	0.880	4.917	1.256	76.02
0.110	0.877	4.940	1.256	76.03
0.201	0.873	4.964	1.256	76.04
0.324	0.870	4.987	1.256	76.06
0.482	0.866	5.011	1.256	76.08
0.679	0.863	5.035	1.257	76.10
0.920	0.859	5.060	1.257	76.13
1.209	0.856	5.085	1.258	76.16
1.554	0.853	5.109	1.258	76.19
1.961	0.849	5.135	1.259	76.23
2.440	0.846	5.160	1.259	76.27

3.003	0.842	5.186	1.260	76.32
3.664	0.839	5.212	1.261	76.37
4.442	0.835	5.238	1.262	76.42
5.361	0.832	5.265	1.263	76.48
6.456	0.829	5.291	1.264	76.54
7.773	0.825	5.319	1.265	76.60
9.382	0.822	5.346	1.266	76.67
11.388	0.818	5.374	1.267	76.75
13.971	0.815	5.402	1.268	76.83
17.465	0.812	5.430	1.270	76.91
22.625	0.808	5.459	1.271	76.99
31.866	0.805	5.488	1.273	77.08
44.100	0.805	5.488	1.273	77.09

 NODE 3000.20 : HGL = < 315.657>;EGL= < 316.026>;FLOWLINE= < 314.770>

 FLOW PROCESS FROM NODE 3000.20 TO NODE 3000.30 IS CODE = 5
 UPSTREAM NODE 3000.30 ELEVATION = 314.97 (FLOW IS SUBCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH (FT.)	VELOCITY (FT/SEC)
UPSTREAM	2.40	18.00	90.00	314.97	0.59	1.648
DOWNSTREAM	5.30	18.00	-	314.77	0.89	4.873
LATERAL #1	2.00	8.00	15.00	315.60	0.63	5.875
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.90===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:

$$DY = (Q2 \cdot V2 - Q1 \cdot V1 \cdot \cos(\Delta 1) - Q3 \cdot V3 \cdot \cos(\Delta 3) - Q4 \cdot V4 \cdot \cos(\Delta 4)) / ((A1 + A2) \cdot 16.1) + \text{FRICTION LOSSES}$$

UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00060

DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00590

AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00325

JUNCTION LENGTH = 2.00 FEET

FRICTION LOSSES = 0.006 FEET ENTRANCE LOSSES = 0.074 FEET

JUNCTION LOSSES = (DY + HV1 - HV2) + (ENTRANCE LOSSES)

JUNCTION LOSSES = (0.065) + (0.074) = 0.138

NODE 3000.30 : HGL = < 316.122>;EGL= < 316.164>;FLOWLINE= < 314.970>

 FLOW PROCESS FROM NODE 3000.30 TO NODE 3001.00 IS CODE = 1
 UPSTREAM NODE 3001.00 ELEVATION = 315.77 (HYDRAULIC JUMP OCCURS)

CALCULATE FRICTION LOSSES (LACFCD):

PIPE FLOW = 2.40 CFS PIPE DIAMETER = 18.00 INCHES

PIPE LENGTH = 159.11 FEET MANNING'S N = 0.01300

HYDRAULIC JUMP: DOWNSTREAM RUN ANALYSIS RESULTS

 NORMAL DEPTH (FT) = 0.59 CRITICAL DEPTH (FT) = 0.59
 =====

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 0.43

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL (FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY (FT)	PRESSURE+ MOMENTUM (POUNDS)
0.000	0.427	5.780	0.947	31.45
1.302	0.434	5.663	0.932	31.07
2.606	0.440	5.550	0.919	30.71
3.912	0.446	5.441	0.906	30.38
5.219	0.453	5.336	0.895	30.07
6.527	0.459	5.234	0.885	29.77
7.837	0.465	5.136	0.875	29.50
9.148	0.472	5.041	0.867	29.24
10.460	0.478	4.950	0.859	29.01
11.774	0.484	4.861	0.851	28.79
13.089	0.491	4.775	0.845	28.58
14.406	0.497	4.692	0.839	28.39
15.724	0.503	4.611	0.834	28.22
17.044	0.510	4.533	0.829	28.07
18.365	0.516	4.457	0.825	27.92
19.688	0.522	4.384	0.821	27.80
21.012	0.529	4.312	0.818	27.68
22.339	0.535	4.243	0.815	27.58
23.669	0.541	4.176	0.812	27.49
25.002	0.548	4.111	0.810	27.42
26.339	0.554	4.047	0.808	27.36
27.682	0.560	3.986	0.807	27.31
29.033	0.567	3.926	0.806	27.27
30.400	0.573	3.867	0.805	27.24
31.806	0.579	3.811	0.805	27.22
37.662	0.585	3.756	0.805	27.21
159.110	0.586	3.756	0.805	27.21

HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS

DOWNSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.15

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL (FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY (FT)	PRESSURE+ MOMENTUM (POUNDS)
0.000	1.152	1.648	1.194	54.74
4.729	1.129	1.681	1.173	52.86
9.454	1.107	1.717	1.152	51.03
14.178	1.084	1.755	1.132	49.26
18.899	1.061	1.795	1.111	47.53
23.619	1.039	1.838	1.091	45.87
28.337	1.016	1.883	1.071	44.26
33.054	0.993	1.931	1.051	42.71
37.769	0.971	1.983	1.032	41.21
42.484	0.948	2.038	1.013	39.78
47.198	0.926	2.096	0.994	38.42
51.910	0.903	2.159	0.975	37.12

56.622	0.880	2.226	0.957	35.88
61.333	0.858	2.297	0.940	34.71
66.044	0.835	2.373	0.923	33.62
70.753	0.812	2.456	0.906	32.60
75.460	0.790	2.544	0.890	31.65
80.166	0.767	2.639	0.875	30.79
84.870	0.745	2.741	0.861	30.00
89.570	0.722	2.851	0.848	29.30
94.266	0.699	2.971	0.836	28.70
98.956	0.677	3.101	0.826	28.18
103.636	0.654	3.242	0.817	27.77
108.299	0.631	3.396	0.811	27.47
112.923	0.609	3.565	0.806	27.28
116.662	0.586	3.750	0.805	27.21
159.110	0.586	3.750	0.805	27.21

-----END OF HYDRAULIC JUMP ANALYSIS-----

| PRESSURE+MOMENTUM BALANCE OCCURS AT 129.60 FEET UPSTREAM OF NODE 3000.30 |
 | DOWNSTREAM DEPTH = 0.601 FEET, UPSTREAM CONJUGATE DEPTH = 0.569 FEET |

NODE 3001.00 : HGL = < 316.197>;EGL= < 316.717>;FLOWLINE= < 315.770>

 FLOW PROCESS FROM NODE 3001.00 TO NODE 3001.10 IS CODE = 5
 UPSTREAM NODE 3001.10 ELEVATION = 316.27 (FLOW IS AT CRITICAL DEPTH)

 CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH (FT.)	VELOCITY (FT/SEC)
UPSTREAM	2.20	12.00	45.00	316.27	0.63	4.189
DOWNSTREAM	2.40	18.00	-	315.77	0.59	3.751
LATERAL #1	0.00	0.00	0.00	0.00	0.00	0.000
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.20===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:

$DY = (Q2 \cdot V2 - Q1 \cdot V1 \cdot \cos(\Delta 1) - Q3 \cdot V3 \cdot \cos(\Delta 3) -$

$Q4 \cdot V4 \cdot \cos(\Delta 4)) / ((A1 + A2) \cdot 16.1) + \text{FRICTION LOSSES}$

UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00716

DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00501

AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00608

JUNCTION LENGTH = 2.00 FEET

FRICTION LOSSES = 0.012 FEET ENTRANCE LOSSES = 0.044 FEET

JUNCTION LOSSES = (DY + HV1 - HV2) + (ENTRANCE LOSSES)

JUNCTION LOSSES = (0.558) + (0.044) = 0.602

 NODE 3001.10 : HGL = < 316.904>;EGL= < 317.177>;FLOWLINE= < 316.270>

 FLOW PROCESS FROM NODE 3001.10 TO NODE 3002.00 IS CODE = 1
 UPSTREAM NODE 3002.00 ELEVATION = 316.37 (FLOW IS SUBCRITICAL)

 CALCULATE FRICTION LOSSES (LACFCD):

PIPE FLOW = 2.20 CFS PIPE DIAMETER = 12.00 INCHES
 PIPE LENGTH = 19.89 FEET MANNING'S N = 0.01300

 NORMAL DEPTH(FT) = 0.72 CRITICAL DEPTH(FT) = 0.63
 =====

DOWNSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 0.63
 =====

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL (FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY (FT)	PRESSURE+ MOMENTUM (POUNDS)
0.000	0.634	4.188	0.907	26.90
0.018	0.638	4.161	0.907	26.90
0.075	0.641	4.135	0.907	26.91
0.173	0.645	4.109	0.907	26.91
0.317	0.648	4.083	0.907	26.92
0.512	0.652	4.058	0.907	26.93
0.762	0.655	4.033	0.908	26.95
1.074	0.659	4.009	0.908	26.96
1.456	0.662	3.985	0.909	26.98
1.915	0.666	3.961	0.909	27.00
2.462	0.669	3.937	0.910	27.02
3.110	0.673	3.914	0.911	27.05
3.873	0.676	3.891	0.911	27.07
4.770	0.680	3.869	0.912	27.10
5.825	0.683	3.847	0.913	27.13
7.069	0.687	3.825	0.914	27.16
8.540	0.690	3.803	0.915	27.20
10.294	0.694	3.782	0.916	27.23
12.408	0.697	3.761	0.917	27.27
14.991	0.701	3.741	0.918	27.31
18.218	0.704	3.720	0.919	27.36
19.890	0.706	3.712	0.920	27.37

 NODE 3002.00 : HGL = < 317.076>;EGL= < 317.290>;FLOWLINE= < 316.370>

 FLOW PROCESS FROM NODE 3002.00 TO NODE 3002.10 IS CODE = 5
 UPSTREAM NODE 3002.10 ELEVATION = 316.57 (FLOW IS SUBCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH (FT.)	VELOCITY (FT/SEC)
UPSTREAM	1.10	12.00	90.00	316.57	0.44	1.432
DOWNSTREAM	2.20	12.00	-	316.37	0.63	3.713
LATERAL #1	0.00	0.00	0.00	0.00	0.00	0.000
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	1.10	==Q5 EQUALS BASIN INPUT==				

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:

$DY = (Q2 \cdot V2 - Q1 \cdot V1 \cdot \cos(\Delta 1) - Q3 \cdot V3 \cdot \cos(\Delta 3) - Q4 \cdot V4 \cdot \cos(\Delta 4)) / ((A1 + A2) \cdot 16.1) + \text{FRICTION LOSSES}$
 UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00082
 DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00533
 AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00308
 JUNCTION LENGTH = 2.00 FEET

FRICITION LOSSES = 0.006 FEET ENTRANCE LOSSES = 0.043 FEET
 JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
 JUNCTION LOSSES = (0.214)+(0.043) = 0.256

NODE 3002.10 : HGL = < 317.514>;EGL= < 317.546>;FLOWLINE= < 316.570>

FLOW PROCESS FROM NODE 3002.10 TO NODE 3003.00 IS CODE = 1
 UPSTREAM NODE 3003.00 ELEVATION = 316.89 (FLOW IS SUBCRITICAL)

CALCULATE FRICTION LOSSES (LACFCD) :

PIPE FLOW = 1.10 CFS PIPE DIAMETER = 12.00 INCHES
 PIPE LENGTH = 63.20 FEET MANNING'S N = 0.01300

NORMAL DEPTH (FT) = 0.46 CRITICAL DEPTH (FT) = 0.44

DOWNSTREAM CONTROL ASSUMED FLOWDEPTH (FT) = 0.94

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL (FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY (FT)	PRESSURE+ MOMENTUM (POUNDS)
0.000	0.944	1.431	0.976	24.86
4.376	0.925	1.449	0.958	23.97
8.724	0.906	1.470	0.939	23.11
13.053	0.886	1.494	0.921	22.26
17.367	0.867	1.520	0.903	21.44
21.670	0.848	1.549	0.885	20.63
25.967	0.828	1.581	0.867	19.85
30.260	0.809	1.616	0.850	19.10
34.553	0.790	1.653	0.832	18.36
38.847	0.770	1.694	0.815	17.66
43.147	0.751	1.738	0.798	16.98
47.456	0.732	1.786	0.781	16.32
51.776	0.712	1.838	0.765	15.70
56.111	0.693	1.894	0.749	15.11
60.466	0.673	1.955	0.733	14.55
63.200	0.661	1.995	0.723	14.21

NODE 3003.00 : HGL = < 317.551>;EGL= < 317.613>;FLOWLINE= < 316.890>

FLOW PROCESS FROM NODE 3003.00 TO NODE 3003.10 IS CODE = 5
 UPSTREAM NODE 3003.10 ELEVATION = 317.09 (FLOW IS SUBCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH (FT.)	VELOCITY (FT/SEC)
UPSTREAM	0.70	12.00	20.00	317.09	0.35	1.571
DOWNSTREAM	1.10	12.00	-	316.89	0.44	1.995
LATERAL #1	0.00	0.00	0.00	0.00	0.00	0.000
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.40===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:

$DY = (Q2*V2 - Q1*V1*\cos(\Delta1) - Q3*V3*\cos(\Delta3) - Q4*V4*\cos(\Delta4)) / ((A1+A2)*16.1) + \text{FRICTION LOSSES}$
 UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00111
 DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00159
 AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00135
 JUNCTION LENGTH = 2.00 FEET
 FRICTION LOSSES = 0.003 FEET ENTRANCE LOSSES = 0.012 FEET
 JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
 JUNCTION LOSSES = (0.056)+(0.012) = 0.068

NODE 3003.10 : HGL = < 317.643>;EGL= < 317.681>;FLOWLINE= < 317.090>

FLOW PROCESS FROM NODE 3003.10 TO NODE 3004.00 IS CODE = 1
 UPSTREAM NODE 3004.00 ELEVATION = 317.31 (FLOW IS SUBCRITICAL)

CALCULATE FRICTION LOSSES(LACFCD):

PIPE FLOW = 0.70 CFS PIPE DIAMETER = 12.00 INCHES
 PIPE LENGTH = 44.73 FEET MANNING'S N = 0.01300

NORMAL DEPTH(FT) = 0.36 CRITICAL DEPTH(FT) = 0.35

DOWNSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 0.55

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL (FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY (FT)	PRESSURE+ MOMENTUM (POUNDS)
0.000	0.553	1.571	0.591	8.72
1.662	0.545	1.598	0.585	8.54
3.328	0.538	1.626	0.579	8.37
4.998	0.530	1.656	0.573	8.21
6.672	0.522	1.686	0.567	8.05
8.352	0.515	1.718	0.561	7.90
10.037	0.507	1.750	0.555	7.75
11.729	0.499	1.784	0.549	7.61
13.427	0.492	1.820	0.543	7.47
15.134	0.484	1.857	0.538	7.34
16.850	0.477	1.895	0.532	7.21
18.576	0.469	1.935	0.527	7.09
20.314	0.461	1.977	0.522	6.98
22.067	0.454	2.020	0.517	6.87
23.837	0.446	2.065	0.512	6.77
25.627	0.438	2.113	0.508	6.68
27.443	0.431	2.162	0.503	6.59
29.289	0.423	2.214	0.499	6.50
31.175	0.415	2.268	0.495	6.43
33.113	0.408	2.324	0.492	6.36
35.123	0.400	2.384	0.488	6.30
37.238	0.393	2.446	0.486	6.25
39.520	0.385	2.511	0.483	6.20
42.109	0.377	2.580	0.481	6.16
44.730	0.371	2.636	0.479	6.14

 NODE 3004.00 : HGL = < 317.681>;EGL= < 317.789>;FLOWLINE= < 317.310>

 FLOW PROCESS FROM NODE 3004.00 TO NODE 3004.10 IS CODE = 5
 UPSTREAM NODE 3004.10 ELEVATION = 317.43 (FLOW IS SUBCRITICAL)

 CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	0.40	8.00	90.00	317.43	0.29	1.413
DOWNSTREAM	0.70	12.00	-	317.31	0.35	2.637
LATERAL #1	0.00	8.00	0.00	0.00	0.00	0.000
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.30	==Q5 EQUALS BASIN INPUT==				

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:

DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
 Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
 UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00129
 DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00448
 AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00288
 JUNCTION LENGTH = 2.00 FEET
 FRICTION LOSSES = 0.006 FEET ENTRANCE LOSSES = 0.022 FEET
 JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
 JUNCTION LOSSES = (0.154)+(0.022) = 0.176

 NODE 3004.10 : HGL = < 317.934>;EGL= < 317.965>;FLOWLINE= < 317.430>

 FLOW PROCESS FROM NODE 3004.10 TO NODE 3004.30 IS CODE = 1
 UPSTREAM NODE 3004.30 ELEVATION = 317.74 (FLOW IS SUBCRITICAL)

 CALCULATE FRICTION LOSSES (LACFCD):

PIPE FLOW = 0.40 CFS PIPE DIAMETER = 8.00 INCHES
 PIPE LENGTH = 57.22 FEET MANNING'S N = 0.01300

 NORMAL DEPTH(FT) = 0.31 CRITICAL DEPTH(FT) = 0.29

 DOWNSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 0.50

 GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	0.504	1.413	0.535	5.09
1.618	0.496	1.435	0.528	4.97
3.240	0.489	1.458	0.522	4.86
4.866	0.481	1.483	0.515	4.75
6.497	0.473	1.508	0.509	4.64
8.134	0.466	1.535	0.502	4.53
9.778	0.458	1.563	0.496	4.43
11.430	0.451	1.593	0.490	4.34
13.090	0.443	1.624	0.484	4.24

14.761	0.435	1.656	0.478	4.15
16.443	0.428	1.690	0.472	4.06
18.140	0.420	1.726	0.466	3.98
19.853	0.412	1.763	0.461	3.90
21.584	0.405	1.802	0.455	3.82
23.339	0.397	1.844	0.450	3.75
25.120	0.390	1.887	0.445	3.68
26.936	0.382	1.933	0.440	3.62
28.793	0.374	1.981	0.435	3.56
30.703	0.367	2.032	0.431	3.50
32.685	0.359	2.086	0.427	3.45
34.763	0.352	2.142	0.423	3.41
36.983	0.344	2.202	0.419	3.37
39.427	0.336	2.266	0.416	3.33
42.284	0.329	2.333	0.413	3.30
46.153	0.321	2.404	0.411	3.27
57.220	0.320	2.410	0.411	3.27

 NODE 3004.30 : HGL = < 318.060>;EGL= < 318.151>;FLOWLINE= < 317.740>

 FLOW PROCESS FROM NODE 3004.30 TO NODE 3004.50 IS CODE = 1
 UPSTREAM NODE 3004.50 ELEVATION = 317.86 (FLOW IS SUBCRITICAL)

 CALCULATE FRICTION LOSSES (LACFCD):

PIPE FLOW = 0.40 CFS PIPE DIAMETER = 8.00 INCHES
 PIPE LENGTH = 24.75 FEET MANNING'S N = 0.01300

 NORMAL DEPTH (FT) = 0.32 CRITICAL DEPTH (FT) = 0.29

=====

DOWNSTREAM CONTROL ASSUMED FLOWDEPTH (FT) = 0.32

=====

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL (FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY (FT)	PRESSURE+ MOMENTUM (POUNDS)
0.000	0.320	2.410	0.411	3.27
0.213	0.321	2.409	0.411	3.27
0.437	0.321	2.408	0.411	3.27
0.671	0.321	2.407	0.411	3.27
0.918	0.321	2.405	0.411	3.27
1.178	0.321	2.404	0.411	3.27
1.453	0.321	2.403	0.411	3.27
1.744	0.321	2.402	0.411	3.27
2.053	0.321	2.400	0.411	3.28
2.383	0.322	2.399	0.411	3.28
2.736	0.322	2.398	0.411	3.28
3.114	0.322	2.397	0.411	3.28
3.523	0.322	2.395	0.411	3.28
3.967	0.322	2.394	0.411	3.28
4.451	0.322	2.393	0.411	3.28
4.985	0.322	2.392	0.411	3.28
5.577	0.322	2.390	0.411	3.28
6.242	0.323	2.389	0.411	3.28

7.000	0.323	2.388	0.411	3.28
7.879	0.323	2.387	0.411	3.28
8.923	0.323	2.385	0.411	3.28
10.207	0.323	2.384	0.411	3.28
11.870	0.323	2.383	0.411	3.28
14.226	0.323	2.382	0.412	3.28
18.278	0.323	2.381	0.412	3.28
24.750	0.323	2.381	0.412	3.28

NODE 3004.50 : HGL = < 318.183>;EGL= < 318.272>;FLOWLINE= < 317.860>

FLOW PROCESS FROM NODE 3004.50 TO NODE 3004.60 IS CODE = 5
UPSTREAM NODE 3004.60 ELEVATION = 318.06 (FLOW IS SUBCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH (FT.)	VELOCITY (FT/SEC)
UPSTREAM	0.20	8.00	0.00	318.06	0.21	1.329
DOWNSTREAM	0.40	8.00	-	317.86	0.29	2.382
LATERAL #1	0.00	0.00	0.00	0.00	0.00	0.000
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.20===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:

$DY = (Q2*V2 - Q1*V1*\cos(\Delta A1) - Q3*V3*\cos(\Delta A3) - Q4*V4*\cos(\Delta A4)) / ((A1+A2)*16.1) + \text{FRICTION LOSSES}$
 UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00163
 DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00486
 AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00324
 JUNCTION LENGTH = 2.00 FEET
 FRICTION LOSSES = 0.006 FEET ENTRANCE LOSSES = 0.018 FEET
 JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
 JUNCTION LOSSES = (0.095)+(0.018) = 0.113

NODE 3004.60 : HGL = < 318.357>;EGL= < 318.385>;FLOWLINE= < 318.060>

FLOW PROCESS FROM NODE 3004.60 TO NODE 3004.70 IS CODE = 1
UPSTREAM NODE 3004.70 ELEVATION = 318.16 (FLOW IS SUBCRITICAL)

CALCULATE FRICTION LOSSES (LACFCD):

PIPE FLOW = 0.20 CFS PIPE DIAMETER = 8.00 INCHES
 PIPE LENGTH = 19.43 FEET MANNING'S N = 0.01300

NORMAL DEPTH (FT) = 0.22 CRITICAL DEPTH (FT) = 0.21

DOWNSTREAM CONTROL ASSUMED FLOWDEPTH (FT) = 0.30

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL (FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY (FT)	PRESSURE+ MOMENTUM (POUNDS)
0.000	0.297	1.329	0.325	1.69

0.687	0.294	1.348	0.322	1.67
1.377	0.291	1.367	0.320	1.65
2.071	0.288	1.387	0.318	1.62
2.769	0.284	1.407	0.315	1.60
3.471	0.281	1.428	0.313	1.58
4.179	0.278	1.450	0.311	1.56
4.892	0.275	1.472	0.309	1.55
5.612	0.272	1.495	0.306	1.53
6.339	0.269	1.519	0.304	1.51
7.074	0.265	1.543	0.302	1.49
7.818	0.262	1.568	0.300	1.48
8.573	0.259	1.594	0.299	1.46
9.341	0.256	1.621	0.297	1.45
10.123	0.253	1.648	0.295	1.44
10.924	0.250	1.677	0.293	1.42
11.746	0.246	1.706	0.292	1.41
12.596	0.243	1.736	0.290	1.40
13.479	0.240	1.767	0.289	1.39
14.408	0.237	1.799	0.287	1.38
15.399	0.234	1.833	0.286	1.37
16.480	0.230	1.867	0.285	1.36
17.704	0.227	1.903	0.284	1.36
19.190	0.224	1.940	0.283	1.35
19.430	0.224	1.944	0.283	1.35

 NODE 3004.70 : HGL = < 318.384>;EGL= < 318.443>;FLOWLINE= < 318.160>

 FLOW PROCESS FROM NODE 3004.70 TO NODE 3004.90 IS CODE = 1
 UPSTREAM NODE 3004.90 ELEVATION = 318.33 (FLOW IS SUBCRITICAL)

 CALCULATE FRICTION LOSSES (LACFCD):

PIPE FLOW = 0.20 CFS PIPE DIAMETER = 8.00 INCHES
 PIPE LENGTH = 32.80 FEET MANNING'S N = 0.01300

 NORMAL DEPTH (FT) = 0.22 CRITICAL DEPTH (FT) = 0.21

=====

DOWNSTREAM CONTROL ASSUMED FLOWDEPTH (FT) = 0.22

=====

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL (FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY (FT)	PRESSURE+ MOMENTUM (POUNDS)
0.000	0.224	1.944	0.283	1.35
0.134	0.224	1.947	0.282	1.35
0.272	0.223	1.950	0.282	1.35
0.414	0.223	1.953	0.282	1.35
0.561	0.223	1.957	0.282	1.35
0.712	0.222	1.960	0.282	1.35
0.869	0.222	1.963	0.282	1.35
1.031	0.222	1.966	0.282	1.35
1.201	0.222	1.969	0.282	1.35
1.377	0.221	1.972	0.282	1.34
1.562	0.221	1.975	0.282	1.34

1.757	0.221	1.978	0.282	1.34
1.963	0.221	1.981	0.282	1.34
2.181	0.220	1.985	0.282	1.34
2.414	0.220	1.988	0.282	1.34
2.666	0.220	1.991	0.282	1.34
2.938	0.220	1.994	0.281	1.34
3.238	0.219	1.997	0.281	1.34
3.571	0.219	2.000	0.281	1.34
3.949	0.219	2.004	0.281	1.34
4.387	0.219	2.007	0.281	1.34
4.912	0.218	2.010	0.281	1.34
5.577	0.218	2.013	0.281	1.34
6.494	0.218	2.017	0.281	1.34
8.032	0.218	2.020	0.281	1.34
32.800	0.218	2.021	0.281	1.34

 NODE 3004.90 : HGL = < 318.548>;EGL= < 318.611>;FLOWLINE= < 318.330>

UPSTREAM PIPE FLOW CONTROL DATA:

NODE NUMBER = 3004.90 FLOWLINE ELEVATION = 318.33
 ASSUMED UPSTREAM CONTROL HGL = 318.54 FOR DOWNSTREAM RUN ANALYSIS

=====
 END OF GRADUALLY VARIED FLOW ANALYSIS

PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE
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***** DESCRIPTION OF STUDY *****
 * HYDRAULIC CALCULATIONS FOR STORM DRAIN LINES 21 AND 22 BASIN C4 *
 * PARK DE LA CRUZ BY NF *
 * JN 141020 *

FILE NAME: AESC4.DAT
 TIME/DATE OF STUDY: 15:18 09/11/2015

GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
 NODAL POINT STATUS TABLE

(Note: "*" indicates nodal point data used.)

NODE NUMBER	MODEL PROCESS	UPSTREAM RUN		DOWNSTREAM RUN	
		PRESSURE HEAD (FT)	PRESSURE+ MOMENTUM (POUNDS)	FLOW DEPTH (FT)	PRESSURE+ MOMENTUM (POUNDS)
4000.00-		0.44 Dc	13.68	0.41*	13.79
	) FRICTION				
4001.00-		0.44*Dc	13.68	0.44*Dc	13.68
	) JUNCTION				
4001.10-		0.46	5.94	0.21*	8.02
	) FRICTION				
4002.00-		0.36*Dc	5.47	0.36*Dc	5.47

 MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE = 25

NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST CONSERVATIVE FORMULAE FROM THE CURRENT LACRD, LACFCD, AND OCEMA DESIGN MANUALS.

DOWNSTREAM PIPE FLOW CONTROL DATA:

NODE NUMBER = 4000.00 FLOWLINE ELEVATION = 315.64
 PIPE FLOW = 1.40 CFS PIPE DIAMETER = 18.00 INCHES
 ASSUMED DOWNSTREAM CONTROL HGL = 315.640 FEET

*NOTE: ASSUMED DOWNSTREAM CONTROL DEPTH(0.00 FT.)
 IS LESS THAN CRITICAL DEPTH(0.44 FT.)

==> CRITICAL DEPTH IS ASSUMED AS DOWNSTREAM CONTROL DEPTH
 FOR UPSTREAM RUN ANALYSIS

NODE 4000.00 : HGL = < 316.053>;EGL= < 316.247>;FLOWLINE= < 315.640>

FLOW PROCESS FROM NODE 4000.00 TO NODE 4001.00 IS CODE = 1
 UPSTREAM NODE 4001.00 ELEVATION = 315.71 (FLOW IS SUPERCRITICAL)

 CALCULATE FRICTION LOSSES (LACFCD):

PIPE FLOW = 1.40 CFS PIPE DIAMETER = 18.00 INCHES
 PIPE LENGTH = 10.66 FEET MANNING'S N = 0.01300

 NORMAL DEPTH (FT) = 0.41 CRITICAL DEPTH (FT) = 0.44
 =====

UPSTREAM CONTROL ASSUMED FLOWDEPTH (FT) = 0.44
 =====

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL (FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY (FT)	PRESSURE+ MOMENTUM (POUNDS)
0.000	0.443	3.204	0.603	13.68
0.004	0.442	3.217	0.603	13.68
0.018	0.441	3.230	0.603	13.68
0.042	0.440	3.243	0.603	13.68
0.077	0.438	3.256	0.603	13.68
0.124	0.437	3.270	0.603	13.68
0.185	0.436	3.283	0.603	13.68
0.260	0.434	3.296	0.603	13.69
0.352	0.433	3.310	0.603	13.69
0.463	0.432	3.323	0.604	13.69
0.595	0.431	3.337	0.604	13.70
0.750	0.429	3.351	0.604	13.70
0.934	0.428	3.365	0.604	13.71
1.149	0.427	3.379	0.604	13.71
1.401	0.426	3.393	0.604	13.72
1.698	0.424	3.407	0.605	13.72
2.049	0.423	3.422	0.605	13.73
2.467	0.422	3.436	0.605	13.74
2.969	0.420	3.451	0.605	13.74
3.583	0.419	3.465	0.606	13.75
4.347	0.418	3.480	0.606	13.76
5.331	0.417	3.495	0.606	13.77
6.662	0.415	3.510	0.607	13.78
8.627	0.414	3.525	0.607	13.79
10.660	0.413	3.534	0.607	13.79

 NODE 4001.00 : HGL = < 316.153>;EGL= < 316.313>;FLOWLINE= < 315.710>

FLOW PROCESS FROM NODE 4001.00 TO NODE 4001.10 IS CODE = 5
 UPSTREAM NODE 4001.10 ELEVATION = 316.54 (FLOW IS SUBCRITICAL)
 (NOTE: POSSIBLE JUMP IN OR UPSTREAM OF STRUCTURE)

 CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH (FT.)	VELOCITY (FT/SEC)
------	------------	-------------------	-----------------	--------------------	----------------------	-------------------

UPSTREAM	0.60	8.00	80.00	316.54	0.36	6.467
DOWNSTREAM	1.40	18.00	-	315.71	0.44	3.205
LATERAL #1	0.00	0.00	0.00	0.00	0.00	0.000
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.80===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:

$DY = (Q2*V2 - Q1*V1*\cos(\Delta A1) - Q3*V3*\cos(\Delta A3) - Q4*V4*\cos(\Delta A4)) / ((A1+A2)*16.1) + \text{FRICTION LOSSES}$
 UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.05561
 DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00491
 AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.03026
 JUNCTION LENGTH = 4.00 FEET
 FRICTION LOSSES = 0.121 FEET ENTRANCE LOSSES = 0.032 FEET
 JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
 JUNCTION LOSSES = (1.052)+(0.032) = 1.084

 NODE 4001.10 : HGL = < 316.748>; EGL = < 317.397>; FLOWLINE = < 316.540>

 FLOW PROCESS FROM NODE 4001.10 TO NODE 4002.00 IS CODE = 1
 UPSTREAM NODE 4002.00 ELEVATION = 318.00 (FLOW IS SUPERCRITICAL)

 CALCULATE FRICTION LOSSES (LACFCD):

PIPE FLOW = 0.60 CFS PIPE DIAMETER = 8.00 INCHES
 PIPE LENGTH = 23.30 FEET MANNING'S N = 0.01300

 NORMAL DEPTH (FT) = 0.20 CRITICAL DEPTH (FT) = 0.36

=====

UPSTREAM CONTROL ASSUMED FLOWDEPTH (FT) = 0.36

=====

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL (FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY (FT)	PRESSURE+ MOMENTUM (POUNDS)
0.000	0.364	3.075	0.511	5.47
0.004	0.358	3.145	0.511	5.48
0.017	0.351	3.218	0.512	5.48
0.040	0.345	3.295	0.513	5.50
0.074	0.338	3.375	0.515	5.52
0.121	0.332	3.460	0.518	5.55
0.181	0.325	3.549	0.521	5.58
0.258	0.319	3.642	0.525	5.62
0.352	0.312	3.740	0.529	5.67
0.467	0.306	3.844	0.535	5.73
0.606	0.299	3.954	0.542	5.79
0.771	0.293	4.070	0.550	5.86
0.970	0.286	4.192	0.559	5.95
1.205	0.279	4.322	0.570	6.04
1.487	0.273	4.459	0.582	6.15
1.822	0.266	4.605	0.596	6.26
2.226	0.260	4.760	0.612	6.39
2.713	0.253	4.925	0.630	6.53
3.309	0.247	5.102	0.651	6.69

4.048	0.240	5.290	0.675	6.86
4.986	0.234	5.491	0.702	7.05
6.213	0.227	5.707	0.733	7.26
7.903	0.221	5.939	0.769	7.48
10.442	0.214	6.188	0.809	7.73
15.073	0.208	6.457	0.856	8.01
23.300	0.208	6.465	0.857	8.02

NODE 4002.00 : HGL = < 318.364>;EGL= < 318.511>;FLOWLINE= < 318.000>

UPSTREAM PIPE FLOW CONTROL DATA:

NODE NUMBER = 4002.00 FLOWLINE ELEVATION = 318.00
ASSUMED UPSTREAM CONTROL HGL = 318.36 FOR DOWNSTREAM RUN ANALYSIS

END OF GRADUALLY VARIED FLOW ANALYSIS

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Analysis prepared by:

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***** DESCRIPTION OF STUDY *****
* HYDRAULIC CALCULATIONS FOR STORM DRAIN LINE 1- BASIN D *
* PARK DE LA CRUZ CALCS BY NF *
* 9/10/2015 *

FILE NAME: MIDD1.DAT
TIME/DATE OF STUDY: 14:47 09/10/2015

GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
NODAL POINT STATUS TABLE

(Note: "*" indicates nodal point data used.)

NODE NUMBER	MODEL PROCESS	UPSTREAM RUN		DOWNSTREAM RUN	
		PRESSURE HEAD (FT)	PRESSURE+ MOMENTUM (POUNDS)	FLOW DEPTH (FT)	PRESSURE+ MOMENTUM (POUNDS)
1000.00-	} FRICTION	0.47 Dc	10.78	0.44*	10.85
1001.00-		0.47*Dc	10.78	0.47*Dc	10.78

MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE = 25

NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
CONSERVATIVE FORMULAE FROM THE CURRENT LACRD, LACFCD, AND OCEMA
DESIGN MANUALS.

DOWNSTREAM PIPE FLOW CONTROL DATA:

NODE NUMBER = 1000.00 FLOWLINE ELEVATION = 321.20
PIPE FLOW = 1.00 CFS PIPE DIAMETER = 8.00 INCHES
ASSUMED DOWNSTREAM CONTROL HGL = 321.200 FEET

*NOTE: ASSUMED DOWNSTREAM CONTROL DEPTH(0.00 FT.)
IS LESS THAN CRITICAL DEPTH(0.47 FT.)

==> CRITICAL DEPTH IS ASSUMED AS DOWNSTREAM CONTROL DEPTH
FOR UPSTREAM RUN ANALYSIS

NODE 1000.00 : HGL = < 321.643>; EGL = < 321.899>; FLOWLINE = < 321.200>

FLOW PROCESS FROM NODE 1000.00 TO NODE 1001.00 IS CODE = 1

UPSTREAM NODE 1001.00 ELEVATION = 321.40 (FLOW IS SUPERCRITICAL)

 CALCULATE FRICTION LOSSES (LACFCD):

PIPE FLOW = 1.00 CFS PIPE DIAMETER = 8.00 INCHES
 PIPE LENGTH = 17.60 FEET MANNING'S N = 0.01300

 NORMAL DEPTH (FT) = 0.44 CRITICAL DEPTH (FT) = 0.47
 =====

UPSTREAM CONTROL ASSUMED FLOWDEPTH (FT) = 0.47
 =====

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL (FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY (FT)	PRESSURE+ MOMENTUM (POUNDS)
0.000	0.474	3.762	0.694	10.78
0.004	0.473	3.774	0.694	10.78
0.015	0.472	3.785	0.694	10.78
0.036	0.470	3.797	0.694	10.78
0.066	0.469	3.808	0.694	10.78
0.106	0.468	3.820	0.695	10.78
0.157	0.466	3.832	0.695	10.78
0.221	0.465	3.844	0.695	10.78
0.300	0.464	3.856	0.695	10.79
0.393	0.463	3.868	0.695	10.79
0.505	0.461	3.880	0.695	10.79
0.637	0.460	3.893	0.695	10.79
0.793	0.459	3.905	0.695	10.80
0.975	0.457	3.917	0.696	10.80
1.189	0.456	3.930	0.696	10.80
1.440	0.455	3.943	0.696	10.81
1.738	0.453	3.956	0.696	10.81
2.092	0.452	3.969	0.697	10.81
2.517	0.451	3.982	0.697	10.82
3.036	0.449	3.995	0.697	10.82
3.682	0.448	4.008	0.698	10.83
4.515	0.447	4.021	0.698	10.83
5.640	0.445	4.035	0.698	10.84
7.300	0.444	4.048	0.699	10.85
10.272	0.443	4.062	0.699	10.85
17.600	0.443	4.063	0.699	10.85

 NODE 1001.00 : HGL = < 321.874>; EGL = < 322.094>; FLOWLINE = < 321.400>

UPSTREAM PIPE FLOW CONTROL DATA:

NODE NUMBER = 1001.00 FLOWLINE ELEVATION = 321.40
 ASSUMED UPSTREAM CONTROL HGL = 321.87 FOR DOWNSTREAM RUN ANALYSIS

=====

END OF GRADUALLY VARIED FLOW ANALYSIS

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Analysis prepared by:

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***** DESCRIPTION OF STUDY *****
 * HYDRAULIC CALCULATIONS FOR STORM DRAIN LINE 2- BASIN D *
 * PARK DE LA CRUZ CALCS BY NF *
 * 9/10/2015 *

FILE NAME: MIDD2.DAT
 TIME/DATE OF STUDY: 14:53 09/10/2015

GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
 NODAL POINT STATUS TABLE
 (Note: "*" indicates nodal point data used.)

NODE NUMBER	MODEL PROCESS	UPSTREAM RUN		DOWNSTREAM RUN	
		PRESSURE HEAD (FT)	PRESSURE+ MOMENTUM (POUNDS)	FLOW DEPTH (FT)	PRESSURE+ MOMENTUM (POUNDS)
1000.00-		0.29*Dc	3.23	0.29*Dc	3.24
	} FRICTION		} HYDRAULIC JUMP		
1002.00-		0.29*Dc	3.23	0.29*Dc	3.23

 MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE = 25

NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST CONSERVATIVE FORMULAE FROM THE CURRENT LACRD, LACFCD, AND OCEMA DESIGN MANUALS.

DOWNSTREAM PIPE FLOW CONTROL DATA:

NODE NUMBER = 1000.00 FLOWLINE ELEVATION = 321.20
 PIPE FLOW = 0.40 CFS PIPE DIAMETER = 8.00 INCHES
 ASSUMED DOWNSTREAM CONTROL HGL = 321.200 FEET

*NOTE: ASSUMED DOWNSTREAM CONTROL DEPTH(0.00 FT.)
 IS LESS THAN CRITICAL DEPTH(0.29 FT.)

====> CRITICAL DEPTH IS ASSUMED AS DOWNSTREAM CONTROL DEPTH
 FOR UPSTREAM RUN ANALYSIS

 NODE 1000.00 : HGL = < 321.495>; EGL = < 321.607>; FLOWLINE = < 321.200>

FLOW PROCESS FROM NODE 1000.00 TO NODE 1002.00 IS CODE = 1
 UPSTREAM NODE 1002.00 ELEVATION = 321.38 (HYDRAULIC JUMP OCCURS)

 CALCULATE FRICTION LOSSES (LACFCD):

PIPE FLOW = 0.40 CFS PIPE DIAMETER = 8.00 INCHES
 PIPE LENGTH = 24.27 FEET MANNING'S N = 0.01300

HYDRAULIC JUMP: DOWNSTREAM RUN ANALYSIS RESULTS

 NORMAL DEPTH (FT) = 0.29 CRITICAL DEPTH (FT) = 0.29
 =====

UPSTREAM CONTROL ASSUMED FLOWDEPTH (FT) = 0.29
 =====

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL (FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY (FT)	PRESSURE+ MOMENTUM (POUNDS)
0.000	0.295	2.689	0.407	3.23
0.001	0.294	2.692	0.407	3.23
0.004	0.294	2.696	0.407	3.23
0.009	0.294	2.700	0.407	3.23
0.017	0.293	2.704	0.407	3.23
0.027	0.293	2.707	0.407	3.23
0.040	0.293	2.711	0.407	3.23
0.057	0.292	2.715	0.407	3.23
0.077	0.292	2.719	0.407	3.23
0.101	0.292	2.723	0.407	3.23
0.129	0.291	2.726	0.407	3.23
0.163	0.291	2.730	0.407	3.23
0.203	0.291	2.734	0.407	3.24
0.250	0.290	2.738	0.407	3.24
0.304	0.290	2.742	0.407	3.24
0.369	0.290	2.746	0.407	3.24
0.445	0.290	2.750	0.407	3.24
0.536	0.289	2.753	0.407	3.24
0.645	0.289	2.757	0.407	3.24
0.778	0.289	2.761	0.407	3.24
0.944	0.288	2.765	0.407	3.24
1.158	0.288	2.769	0.407	3.24
1.447	0.288	2.773	0.407	3.24
1.873	0.287	2.777	0.407	3.24
2.636	0.287	2.781	0.407	3.24
24.270	0.287	2.783	0.407	3.24

 HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS

 UPSTREAM CONTROL ASSUMED FLOWDEPTH (FT) = 0.29
 =====

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL (FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY (FT)	PRESSURE+ MOMENTUM (POUNDS)
0.000	0.295	2.689	0.407	3.23
0.001	0.294	2.692	0.407	3.23
0.004	0.294	2.696	0.407	3.23
0.009	0.294	2.700	0.407	3.23

0.017	0.293	2.704	0.407	3.23
0.027	0.293	2.707	0.407	3.23
0.040	0.293	2.711	0.407	3.23
0.057	0.292	2.715	0.407	3.23
0.077	0.292	2.719	0.407	3.23
0.101	0.292	2.723	0.407	3.23
0.129	0.291	2.726	0.407	3.23
0.163	0.291	2.730	0.407	3.23
0.203	0.291	2.734	0.407	3.24
0.250	0.290	2.738	0.407	3.24
0.304	0.290	2.742	0.407	3.24
0.369	0.290	2.746	0.407	3.24
0.445	0.290	2.750	0.407	3.24
0.536	0.289	2.753	0.407	3.24
0.645	0.289	2.757	0.407	3.24
0.778	0.289	2.761	0.407	3.24
0.944	0.288	2.765	0.407	3.24
1.158	0.288	2.769	0.407	3.24
1.447	0.288	2.773	0.407	3.24
1.873	0.287	2.777	0.407	3.24
2.636	0.287	2.781	0.407	3.24
24.270	0.287	2.783	0.407	3.24

-----END OF HYDRAULIC JUMP ANALYSIS-----

| PRESSURE+MOMENTUM BALANCE OCCURS AT 12.14 FEET UPSTREAM OF NODE 1000.00 |
 | DOWNSTREAM DEPTH = 0.287 FEET, UPSTREAM CONJUGATE DEPTH = 0.287 FEET |

NODE 1002.00 : HGL = < 321.675>;EGL= < 321.787>;FLOWLINE= < 321.380>

UPSTREAM PIPE FLOW CONTROL DATA:

NODE NUMBER = 1002.00

FLOWLINE ELEVATION = 321.38

ASSUMED UPSTREAM CONTROL HGL = 321.67 FOR DOWNSTREAM RUN ANALYSIS

=====

END OF GRADUALLY VARIED FLOW ANALYSIS

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Analysis prepared by:

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***** DESCRIPTION OF STUDY *****
 * HYDRAULIC CALCULATIONS FOR MID CITY SKATE PARK EXPANSION AREA *
 * STORM DRAIN LINE 3- 8" FROM TURF AREA. *
 * CALCS BY NF 10/20/2015 *

FILE NAME: AESMIDD3.DAT
 TIME/DATE OF STUDY: 08:49 10/20/2015

GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
 NODAL POINT STATUS TABLE

(Note: "*" indicates nodal point data used.)

NODE NUMBER	MODEL PROCESS	UPSTREAM RUN		DOWNSTREAM RUN	
		PRESSURE HEAD (FT)	PRESSURE+ MOMENTUM (POUNDS)	FLOW DEPTH (FT)	PRESSURE+ MOMENTUM (POUNDS)
1003.00-	) FRICTION	0.47*Dc	10.78	0.47*Dc	10.78
1004.00-		0.53*	11.01	0.47 Dc	10.78

 MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE = 25

NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
 CONSERVATIVE FORMULAE FROM THE CURRENT LACRD, LACFCD, AND OCEMA
 DESIGN MANUALS.

DOWNSTREAM PIPE FLOW CONTROL DATA:

NODE NUMBER = 1003.00 FLOWLINE ELEVATION = 325.80

PIPE FLOW = 1.00 CFS PIPE DIAMETER = 8.00 INCHES

ASSUMED DOWNSTREAM CONTROL HGL = 325.800 FEET

*NOTE: ASSUMED DOWNSTREAM CONTROL DEPTH(0.00 FT.)

IS LESS THAN CRITICAL DEPTH(0.47 FT.)

====> CRITICAL DEPTH IS ASSUMED AS DOWNSTREAM CONTROL DEPTH
 FOR UPSTREAM RUN ANALYSIS

 NODE 1003.00 : HGL = < 326.274>; EGL = < 326.494>; FLOWLINE = < 325.800>

FLOW PROCESS FROM NODE 1003.00 TO NODE 1004.00 IS CODE = 1
 UPSTREAM NODE 1004.00 ELEVATION = 325.91 (FLOW IS SUBCRITICAL)

 CALCULATE FRICTION LOSSES (LACFCD):

PIPE FLOW = 1.00 CFS PIPE DIAMETER = 8.00 INCHES
 PIPE LENGTH = 16.22 FEET MANNING'S N = 0.01300

NORMAL DEPTH (FT) = 0.55 & 0.67 CRITICAL DEPTH (FT) = 0.47
 NOTE: SUGGEST CONSIDERATION OF WAVE ACTION, UNCERTAINTY, ETC.
 =====

DOWNSTREAM CONTROL ASSUMED FLOWDEPTH (FT) = 0.47
 =====

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL (FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY (FT)	PRESSURE+ MOMENTUM (POUNDS)
0.000	0.474	3.762	0.694	10.78
0.015	0.477	3.737	0.694	10.78
0.062	0.480	3.712	0.695	10.78
0.144	0.483	3.688	0.695	10.78
0.265	0.486	3.664	0.695	10.79
0.428	0.489	3.640	0.695	10.79
0.639	0.492	3.617	0.696	10.80
0.903	0.495	3.594	0.696	10.81
1.226	0.498	3.572	0.697	10.82
1.617	0.501	3.550	0.697	10.83
2.085	0.504	3.528	0.698	10.84
2.640	0.507	3.507	0.698	10.85
3.298	0.510	3.486	0.699	10.86
4.074	0.513	3.466	0.700	10.88
4.990	0.516	3.446	0.701	10.89
6.075	0.519	3.426	0.702	10.91
7.365	0.522	3.407	0.703	10.93
8.910	0.525	3.388	0.704	10.94
10.781	0.528	3.369	0.705	10.96
13.080	0.531	3.351	0.706	10.98
15.967	0.534	3.333	0.707	11.01
16.220	0.535	3.332	0.707	11.01

 NODE 1004.00 : HGL = < 326.445>; EGL = < 326.617>; FLOWLINE = < 325.910>

UPSTREAM PIPE FLOW CONTROL DATA:

NODE NUMBER = 1004.00 FLOWLINE ELEVATION = 325.91
 ASSUMED UPSTREAM CONTROL HGL = 326.38 FOR DOWNSTREAM RUN ANALYSIS
 =====

END OF GRADUALLY VARIED FLOW ANALYSIS

Capacity of Catch Basins

Capacity Calculations for 12"x 12" C.B.

$$Q_{max}/P = 3.0 * H^{3/2}$$

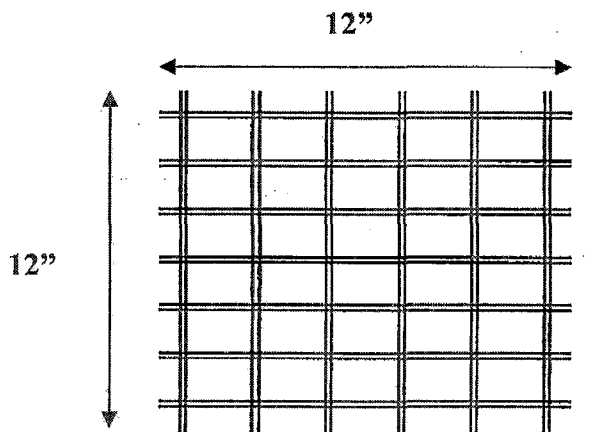
Q – Storm runoff

P – Perimeter of catch basin grate (12" x 12" Area Drain $P=12''+12''+12''+12''=4.0'$)

H – Head (3" depression, $H=0.25'$)

Assuming grate is half clogged: ($P=4.0'/2=2.0'$)

$$Q_{max} = (3.0 * 0.5'^{3/2}) * 2.0' = 2.12 \text{ cfs}$$



12" x 12" AREA DRAIN GRATE

Capacity Calculations for 24"x 24" C.B.

$$Q_{max}/P = 3.0 * H^{3/2}$$

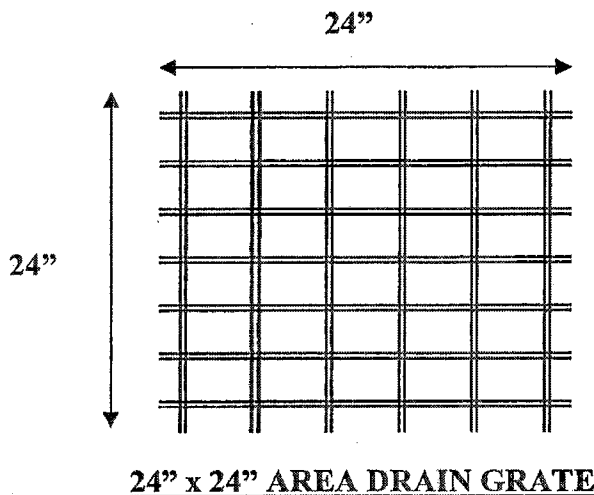
Q – Storm runoff

P – Perimeter of catch basin grate (24" x 24" Area Drain P=24"+24"+24"+24"=8.0')

H – Head (with 3" depression, H=0.25')

Assuming grate is half clogged: (P=8.0'/2=4.0')

$$Q_{max} = (3.0 * 0.25'^{3/2}) * 4.0' = 1.50 \text{ cfs}$$



Capacity Calculations Type 'F' Catch Basin with slot

$$Q_{max}/A = 3.0 * H^{3/2}$$

Q – Storm runoff

A – Area of the orifice opening = 2.0' X 6" = 1sf * 4 sides = 4sf. If assumed half clogged, 2.0sf

H – Head (H=0.5')

$$Q_{max} = (3.0 * 0.5'^{3/2}) * 2.0' = 2.12 \text{ cfs}$$

Catch Basin Capacity for 100 Year Storm			
Basin Area (See Exhibit W)	100 YR Flowrate (See Appendix B)	Size of Catch Basin	QCapacity
Basin C1A	1.44	24"X24"	1.50 cfs
Basin C3A	0.25	24"X24"	1.50 cfs
Basin C3B	0.36	24"x24"	1.50 cfs
Basin C3C	0.89	24"X24"	1.50 cfs
Basin C3D	0.07	24"x24"	1.50 cfs
Basin C3E	2.20	24"X24"	4.24 cfs (6" depression)
Basin C3F	0.08	24"X24"	1.50 cfs
Basin C3G	0.12	12"X12"	0.75 cfs
Basin C3H	0.17	12"X12"	0.75 cfs
Basin C3I	0.17	12"X12"	0.75 cfs
Basin C4A	0.63	12"X12"	0.75 cfs
Basin C4B	0.61	Type 'F'	2.12 cfs
BASIN D2A	1.08	24"X24"	1.50 cfs
BASIN D2B	0.42	Type 'F'	2.12 cfs

Summary of 50 Year Hydrologic Calculations for Skate Park															
Description Process	NODE	ELEV	NODE	ELEV	Length	SLOPE ¹	Time ³ (min)	I ⁴ (in/hr)	AREA (sf)	AREA (AC)	C	AC	Q ⁵ cfs	Velocity (fps) ²	SD Size
Initial Area															
BASIN 1	9	326.5	8	320.35	52	11.8%	5.0 ⁶	4.2	3750	0.09	0.95	0.1	0.34		
Travel Time	8	317.68	7	317.2	48.6	1.0%	0.3							2.83	8"
BASIN 2							Total Time = 5.3	4.1	3440	0.08	0.95	0.1	0.64		
Travel Time	7	317.2	6	316.48	71.9	1.0%	0.4							3.42	8"
BASIN 3							Total Time = 5.7	4	2970	0.07	0.95	0.1	0.89		
Travel Time	6	316.48	5	316.06	42	1.0%	0.2							3.72	8"
BASIN 4							Total Time = 5.9	3.95	1930	0.04	0.95	0.0	1.04		
Travel Time	5	316.06	4	315.6	46.4	1.0%	0.2							3.84	8"
BASIN 5							Total Time = 6.1	3.9	2440	0.06	0.95	0.1	1.24		
Travel Time	4	315.6	3	312.67	42.5	6.9%	0.1							8.43	8"
BASIN 6							Total Time = 6.2	3.9	3440	0.08	0.95	0.1	1.53		
Travel Time	3	312.67	2	312.39	56.6	0.5%	0.3							2.80	8"
BASIN 7							Total Time = 6.5	3.85	1170	0.03	0.95	0.0	1.61		
Travel Time	2	312.39	1	312.27	23.3	0.5%	0.1							2.80	8"

¹ Slope = Change in Elev/ Length

² Velocity, based on Mannings Equation, $V = (1.486/n)R^{(2/3)} S^{(1/2)}$, n= 0.015 for concrete, R= Hydraulic Radius, based on Q and Assumed SD size.

³ Travel Time = Length/Velocity/60, unless otherwise noted

⁴ Intensity= Use Total Time and Exhibit C to determine I at 50 year storm frequency

⁵ Q (50 Year flowrate)= (ΣCA)* I

⁶ Initial time of concentration per Urban Areas Overland Time of Flow Curves, see Exhibit N.

See Proposed Hydrology Map for Skate Park, Exhibit W, Sheet 2 of 2.

Based on the table above, during a 50 year storm event, 1.61 cfs will be generated from the skate park. Due to the site constraints, a pump is proposed to pump storm water from the southwest corner of the skate park to the biofiltration facility to the west. The pump is rated at 50 gpm, which equates to 0.11 cfs. During a 50 year storm event storm water will pond in the skate park until it can be pumped out.

Based on the a Q50=1.61 cfs and a 6 hour storm, the inflow hydrograph is depicted below.

Hydrograph Report

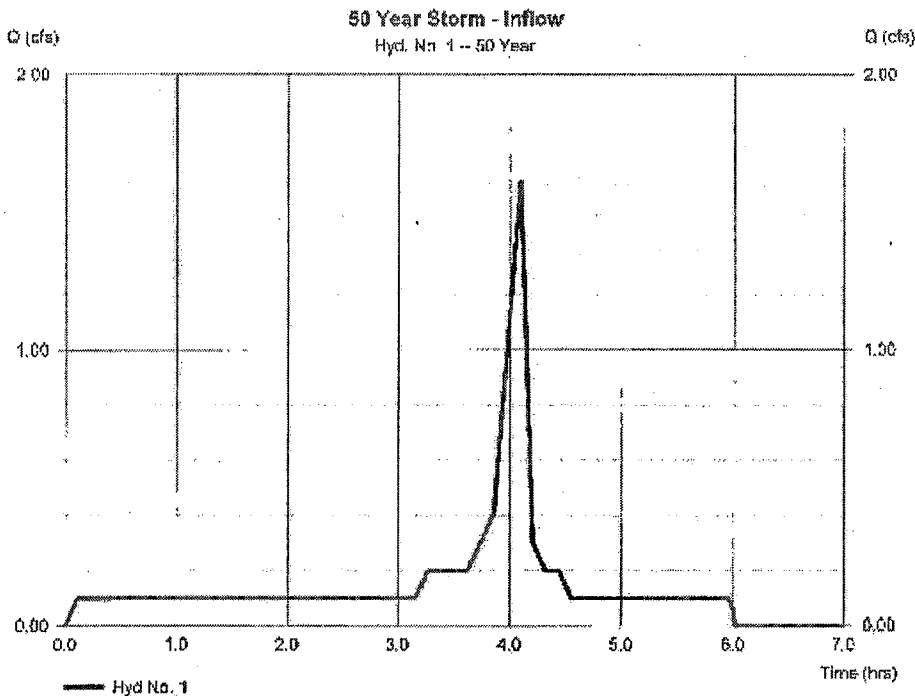
Hydratlow Hydrograph Extension for AutoCAD Civil 3D 2014 by Autodesk, Inc. v10.5

Wednesday, 11/26/2015

Hyd. No. 1

50 Year Storm - Inflow

Hydrograph type	= Manual	Peak discharge	= 1.610 cfs ←
Storm frequency	= 50 yrs	Time to peak	= 4.08 hrs ←
Time interval	= 1 min	Hyd. volume	= 3.696 cuft ←



Since the outflow of the pump is less than the inflow from a 50 year storm event, the volume of stormwater detained in the skate park is 2,193 cf. The water elevation will be approximately 321.0, based on the geometry of the bowl near the southwest end. See the figure below.

Hydrograph Report

Hydroflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Wednesday, 12 / 28 / 2015

Hyd. No. 2

Pump Outflow- Storage

Hydrograph type	= Reservoir	Peak discharge	= 0.110 cfs ← PUMP 50gpm
Storm frequency	= 50 yrs	Time to peak	= 3.85 hrs
Time interval	= 1 min	Hyd. volume	= 3,687 cuft
Inflow hyd. No.	= 1 - 50 Year Storm - Inflow	Max. Elevation	= 17.13 ft
Reservoir name	= Skate Park Bowl	Max. Storage	= 2,193 cuft ←

Storage calculation method: ishd

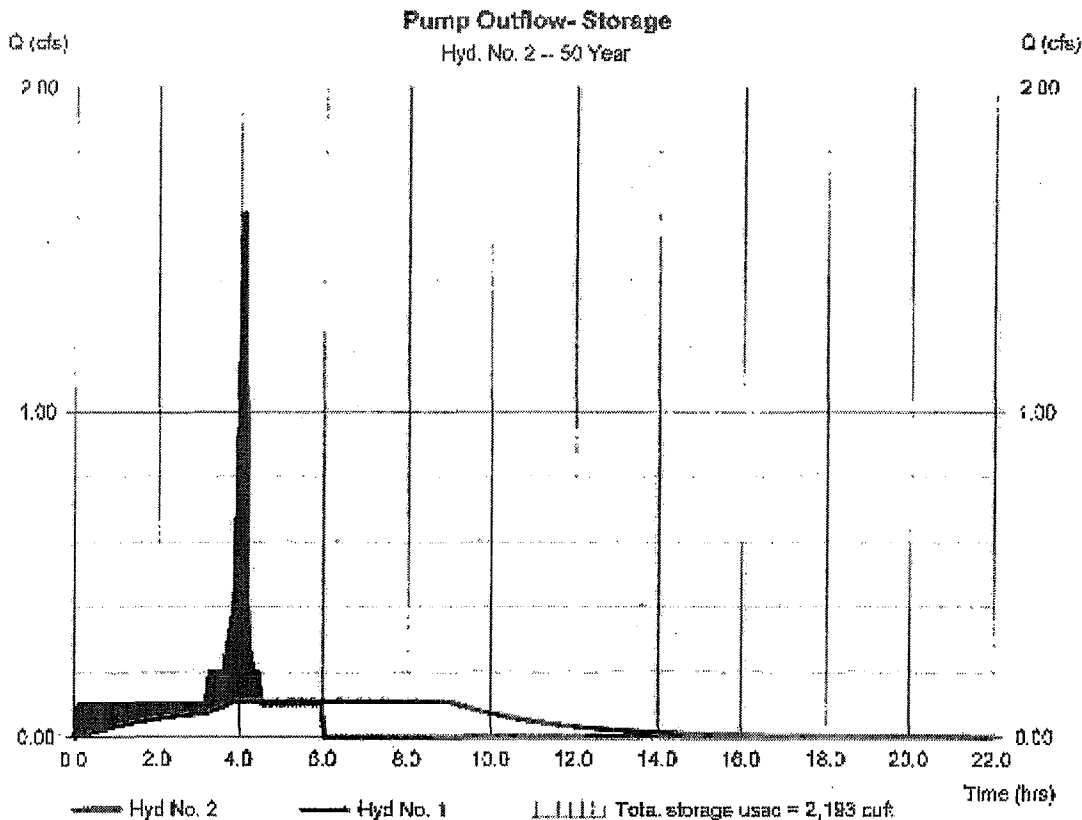
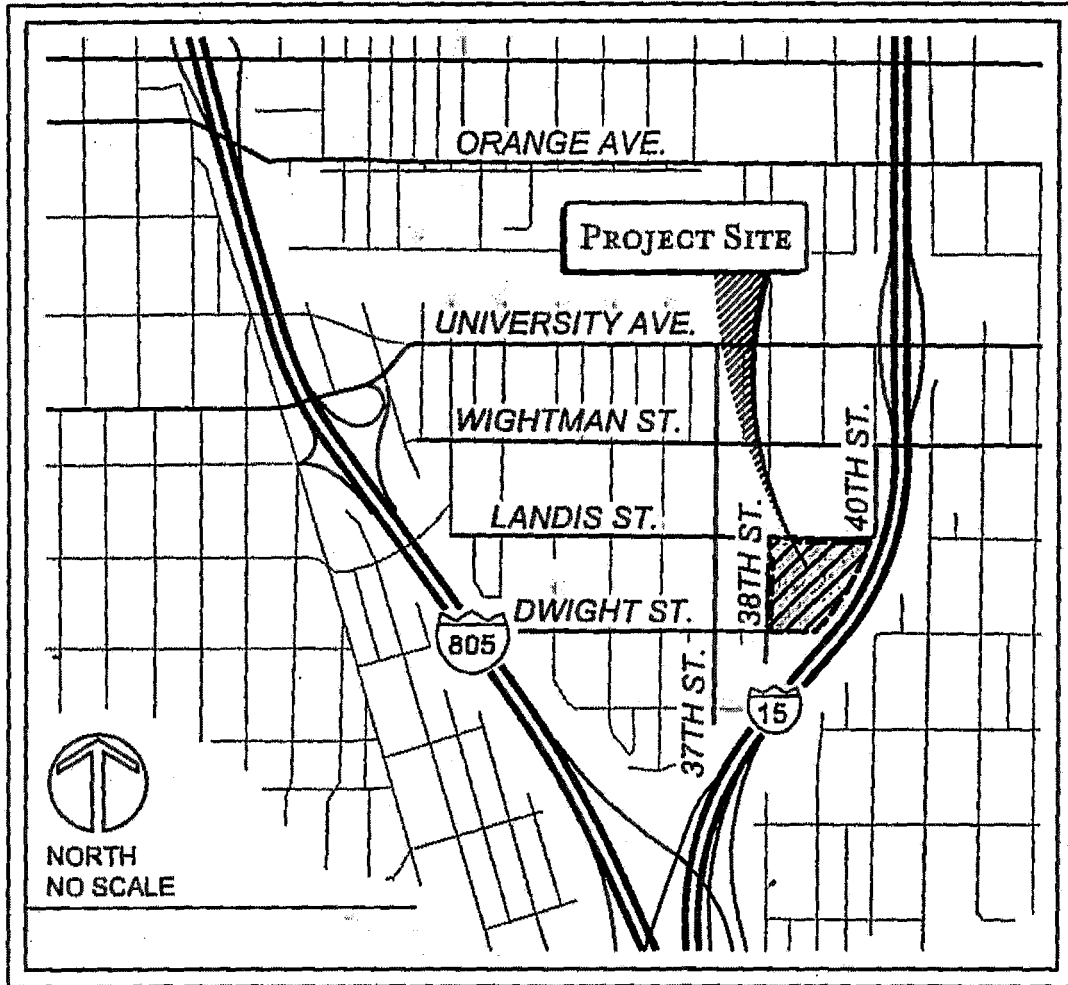


EXHIBIT A



VICINITY MAP



City of San Diego
Development Services
1222 First Ave., MS-302
San Diego, CA 92101
(619) 446-5000

THE CITY OF SAN DIEGO

Storm Water Requirements Applicability Checklist

FORM
DS-560
JANUARY 2011

Project Address: Park De La Cruz Project Number (for City Use Only):

SECTION 1. Permanent Storm Water BMP Requirements:

Additional information for determining the requirements is found in the Storm Water Standards Manual.

Part A: Determine if Exempt from Permanent Storm Water BMP Requirements.

Projects that are considered maintenance, or are otherwise not categorized as "development projects" or "redevelopment projects" according to the Storm Water Standards manual are not required to install permanent storm water BMPs. If "Yes" is checked for any line in Part A, proceed to Part C and check the box labeled "Exempt Project." If "No" is checked for all of the lines, continue to Part B.

1. The project is not a Development Project as defined in the Storm Water Standards Manual: for example habitat restoration projects, and construction inside an existing building. Yes No
2. The project is only the construction of underground or overhead linear utilities. Yes No
3. The project qualifies as routine maintenance (replaces or renews existing surface materials because of failed or deteriorating condition). This includes roof replacement, pavement spot repairs and resurfacing treatments such as asphalt overlay or slurry seal, and replacement of damaged pavement. Yes No
4. The project only installs sidewalks, bike lanes, or pedestrian ramps on an existing road, and does not change sheet flow condition to a concentrated flow condition. Yes No

Part B: Determine if Subject to Priority Development Project Requirements.

Projects that match one of the definitions below are subject to additional requirements including preparation of a Water Quality Technical Report.

If "Yes" is checked for any line in Part B, proceed to Part C and check the box labeled "Priority Development Project." If "No" is checked for all of the lines, continue to Part C and check the box labeled "Standard Development Project."

1. Residential development of 10 or more units. Yes No
2. Commercial development and similar non-residential development greater than one acre. Hospitals; laboratories and other medical facilities; educational institutions; recreational facilities; municipal facilities; commercial nurseries; multi-apartment buildings; car wash facilities; mini-malls and other business complexes; shopping malls; hotels; office buildings; public warehouses; automotive dealerships; and other light industrial facilities. Yes No
3. Heavy industrial development greater than one acre. Manufacturing plants, food processing plants, metal working facilities, printing plants, and fleet storage areas. Yes No
4. Automotive repair shop. Facilities categorized in any one of Standard Industrial Classification (SIC) codes 5013, 5014, 5541, 7532-7534, or 7536-7539. Yes No
5. Restaurant. Facilities that sells prepared foods and drinks for consumption, including stationary lunch counters and refreshment stands selling prepared foods and drinks for immediate consumption (SIC code 5812), and where the land area for development is greater than 5,000 square feet. Yes No
6. Hillside development greater than 5,000 square feet. Development that creates 5,000 square feet of impervious surface and is located in an area with known erosive soil conditions and where the development will grade on any natural slope that is twenty-five percent or greater. Yes No
7. Water Quality Sensitive Area. Development located within, directly adjacent to, or discharging directly to a Water Quality Sensitive Area (as depicted in Appendix C) in which the project either creates 2,500 square feet of impervious surface on a proposed project site or increases the area of imperviousness of a proposed project site to 10% or more of its naturally occurring condition. "Directly adjacent" is defined as being situated within 200 feet of the Water Quality Sensitive Area. "Discharging directly to" is defined as outflow from a drainage conveyance system that is composed entirely of flows from the subject development or redevelopment site, and not commingled with flows from adjacent lands. Yes No
8. Parking lot with a minimum area of 5,000 square feet or a minimum of 15 parking spaces and potential exposure to urban runoff (unless it meets the exclusion for parking lot reconfiguration on line 11). Yes No

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Upon request, this information is available in alternative formats for persons with disabilities.

DS-560 (01-25-11)

9. **Street, road, highway, or freeway.** New paved surface in excess of 5,000 square feet used for the transportation of automobiles, trucks, motorcycles, and other vehicles (unless it meets the exclusion for road reconfiguration on line 11). Yes No
10. **Retail Gasoline Outlet (RGO)** that is: (a) 5,000 square feet or more or (b) has a projected Average Daily Traffic (ADT) of 100 or more vehicles per day. Yes No
11. **Significant Redevelopment;** project installs and/or replaces 5,000 square feet or more of impervious surface and the existing site meets at least one of the categories above. The project is not considered Significant Redevelopment if reconfiguring an existing road or parking lot without a change to the footprint of an existing developed road or parking lot. The existing footprint is defined as the outside curb or the outside edge of pavement when there is no curb. Yes No
12. **Other Pollutant Generating Project.** Any other project not covered in the categories above, that disturbs one acre or more and is not excluded by the criteria below. Yes No
- Projects creating less than 5,000 sf of impervious surface and where added landscaping does not require regular use of pesticides and fertilizers, such as slope stabilization using native plants. Calculation of the square footage of impervious surface need not include linear pathways that are for infrequent vehicle use, such as emergency maintenance access or bicycle pedestrian use, if they are built with pervious surfaces or if they sheet flow to surrounding pervious surfaces.*

Part C: Select the appropriate category based on the outcome of Parts A & B.

1. If "Yes" is checked for any line in Part A, then check this box. Continue to Section 2. Exempt Project
2. If "No" is checked for all lines in Part A, and Part B, then check this box. Continue to Section 2. Standard Development Project
3. If "No" is checked for all lines in Part A, and "Yes" is checked for at least one of the lines in Part B, then check this box. Continue to Section 2. See the Storm Water Standards Manual for guidance on determining if Hydromodification Management Plan requirements apply. Priority Development Project

SECTION 2. Construction Storm Water BMP Requirements:
For all projects, complete Part D. If "Yes" is checked for any line in Part D, then continue to Part E.

Part D: Determine Construction Phase Storm Water Requirements.

1. Is the project subject to California's statewide General NPDES Permit for Storm Water Discharges Associated with Construction Activities? (See State Water Resources Control Board Order No. 2009-0009-DWQ for rules on enrollment) Yes No
2. Does the project propose grading or soil disturbance? Yes No
3. Would storm water or urban runoff have the potential to contact any portion of the construction area, including washing and staging areas? Yes No
4. Would the project use any construction materials that could negatively affect water quality if discharged from the site (such as, paints, solvents, concrete, and stucco)? Yes No
5. Check this box if "Yes" is checked for line 1, Continue to Part E. SWPPP Required
6. Check this box if "No" is checked for line 1, and "Yes" is checked for any line 2-4. Continue to Part E. WPCP Required
7. Check this box if "No" is checked for all lines 1-4, Part E does not apply. No Document Required

Part E: Determine Construction Site Priority

This prioritization must be completed with this form, noted on the plans, and included in the SWPPP or WPCP. The City reserves the right to adjust the priority of the projects both before and during construction. [Note: The construction priority does NOT change construction BMP requirements that apply to projects; rather, it determines the frequency of inspections that will be conducted by City staff.]

- 1. High Priority**
- a) Projects where the site is 50 acres or more and grading will occur during the wet season
 - b) Projects 1 acre or more and tributary to an impaired water body for sediment (e.g., Peñasquitos watershed)
 - c) Projects 1 acre or more within or directly adjacent to or discharging directly to a coastal lagoon or other receiving water within a Water Quality Sensitive Area.
 - d) Projects subject to phased grading or advanced treatment requirements.
- 2 Medium Priority.** Projects 1 acre or more but not subject to a high priority designation.
- 3 Low Priority.** Projects requiring a Water Pollution Control Plan but not subject to a medium or high priority designation.

Name of Owner or Agent (Please Print):

Title:

Signature:

Date:

EXHIBIT D

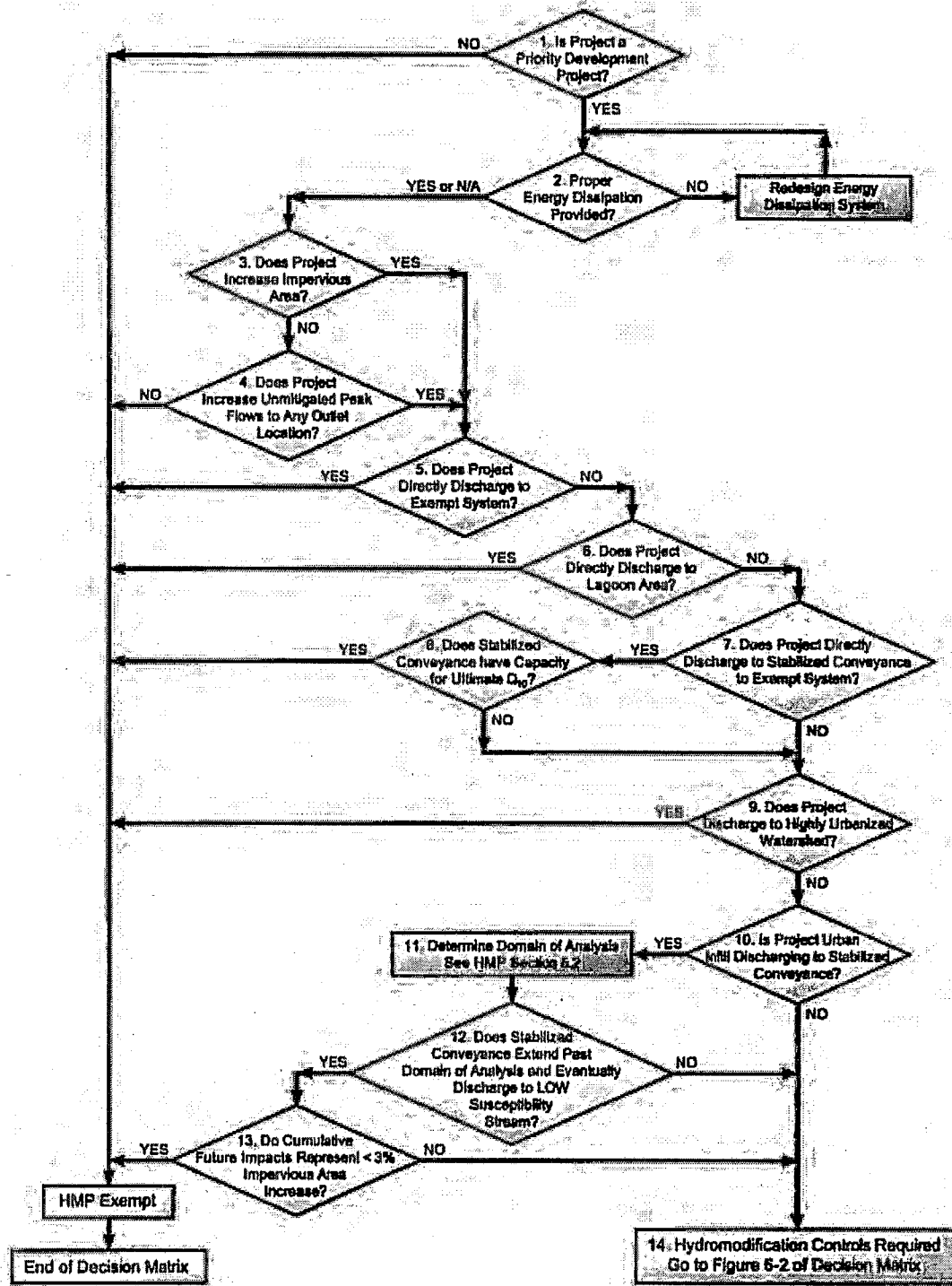


Figure 4-1. HMP Applicability Determination

Table 4-1. Anticipated and Potential Pollutants Generated by Land Use Type.

General Project Categories	General Pollutant Categories								
	Sediments	Nutrients	Heavy Metals	Organic Compounds	Trash & Debris	Oxygen Demanding Substances	Oil & Grease	Bacteria & Viruses	Pesticides
Detached Residential Housing Development	X	X			X	X	X	X	X
Attached Residential Development	X	X			X	P ⁽¹⁾	P ⁽²⁾	P	X
Commercial Development	P ⁽¹⁾	P ⁽¹⁾	X	P ⁽²⁾	X	P ⁽⁵⁾	X	P ⁽³⁾	P ⁽⁴⁾
Industrial Development	X		X	X	X	X	X		
Automotive Repair Shops			X	X ⁽⁴⁾⁽⁵⁾	X		X		
Restaurants					X	X	X	X	P ⁽¹⁾
Steep Hillside Developments	X	X			X	X	X		X
Parking Lots	P ⁽¹⁾	P ⁽¹⁾	X		X	P ⁽¹⁾	X		P ⁽¹⁾
Streets, Highways & Freeways	X	P ⁽¹⁾	X	X ⁽⁴⁾	X	P ⁽⁵⁾	X	X	P ⁽¹⁾
Retail Gasoline Outlets (RGO)			X	X	X	X	X		

X = anticipated

P = potential

(1) A potential pollutant if landscaping exists on-site.

(2) A potential pollutant if the project includes uncovered parking areas.

(3) A potential pollutant if land use involves food or animal waste products.

(4) Including petroleum hydrocarbons.

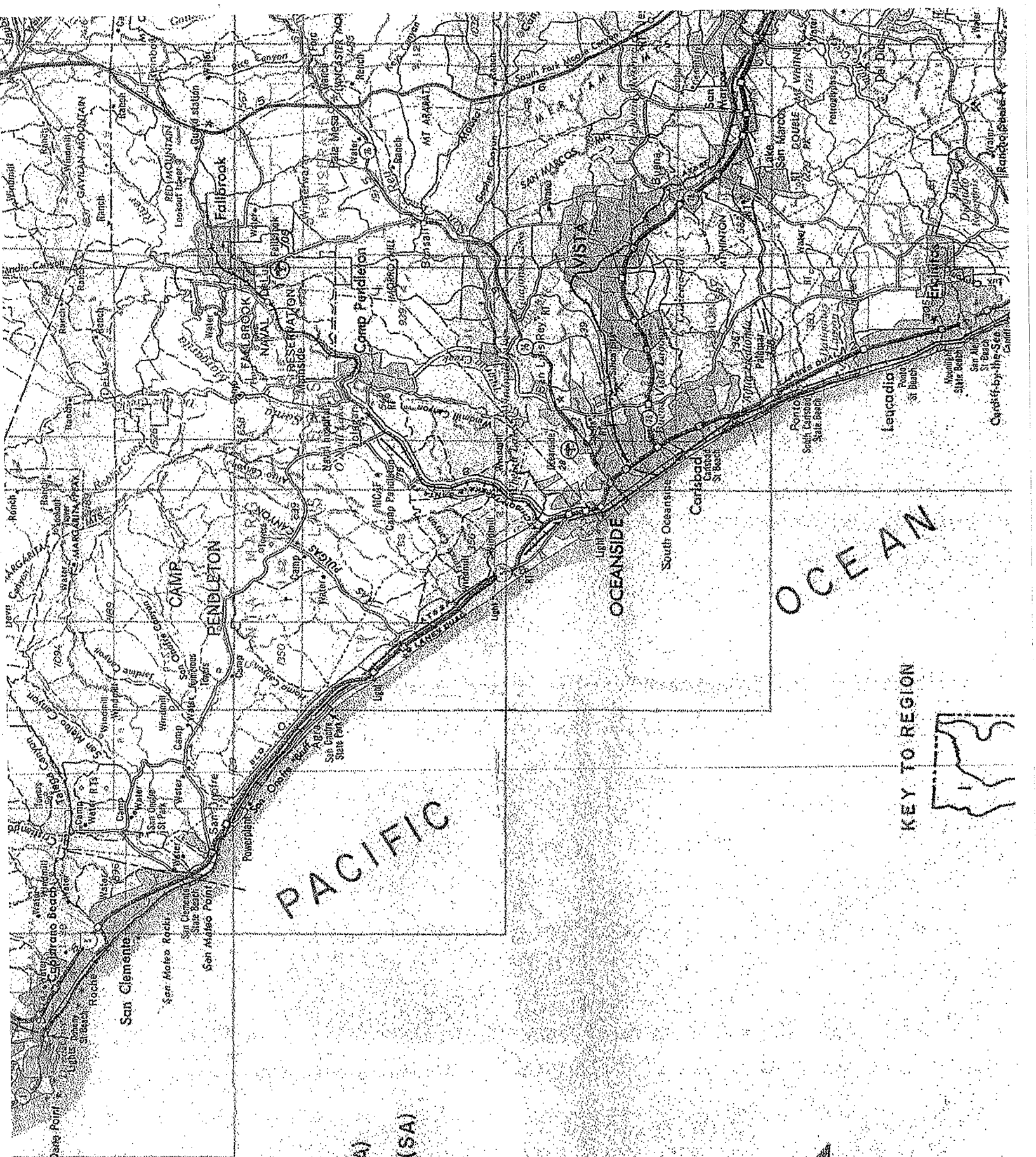
(5) Including solvents.

4.1.6 Identification of Pollutants of Concern for the Receiving Water

For PDPs, the following analysis shall be conducted and reported in the project's Water Quality Technical Report:

- For each of the proposed project discharge points, identify the receiving waters (including hydrologic unit basin numbers) as identified in the most recent version of the *Water Quality Control Plan for the San Diego Basin*², prepared by the RWQCB (see Suggested Resources in Appendix A).

² To view a copy of the Basin Plan, go to: <http://www.swrcb.ca.gov/rwqcb9/programs/basinplan.html>

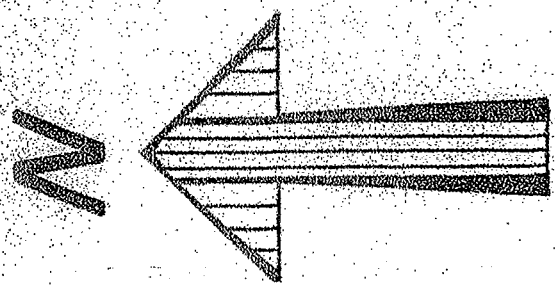


dary

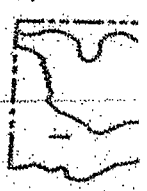
it Boundary (HU)

ea Boundary (HA)

oarea Boundary (SA)



KEY TO REGION



Note: ID numbers denoting "2006 CWA Section 303(d) List of Water Quality Segments" are illustrated on the following map. These ID numbers may be cross-referenced with the tables following the map.

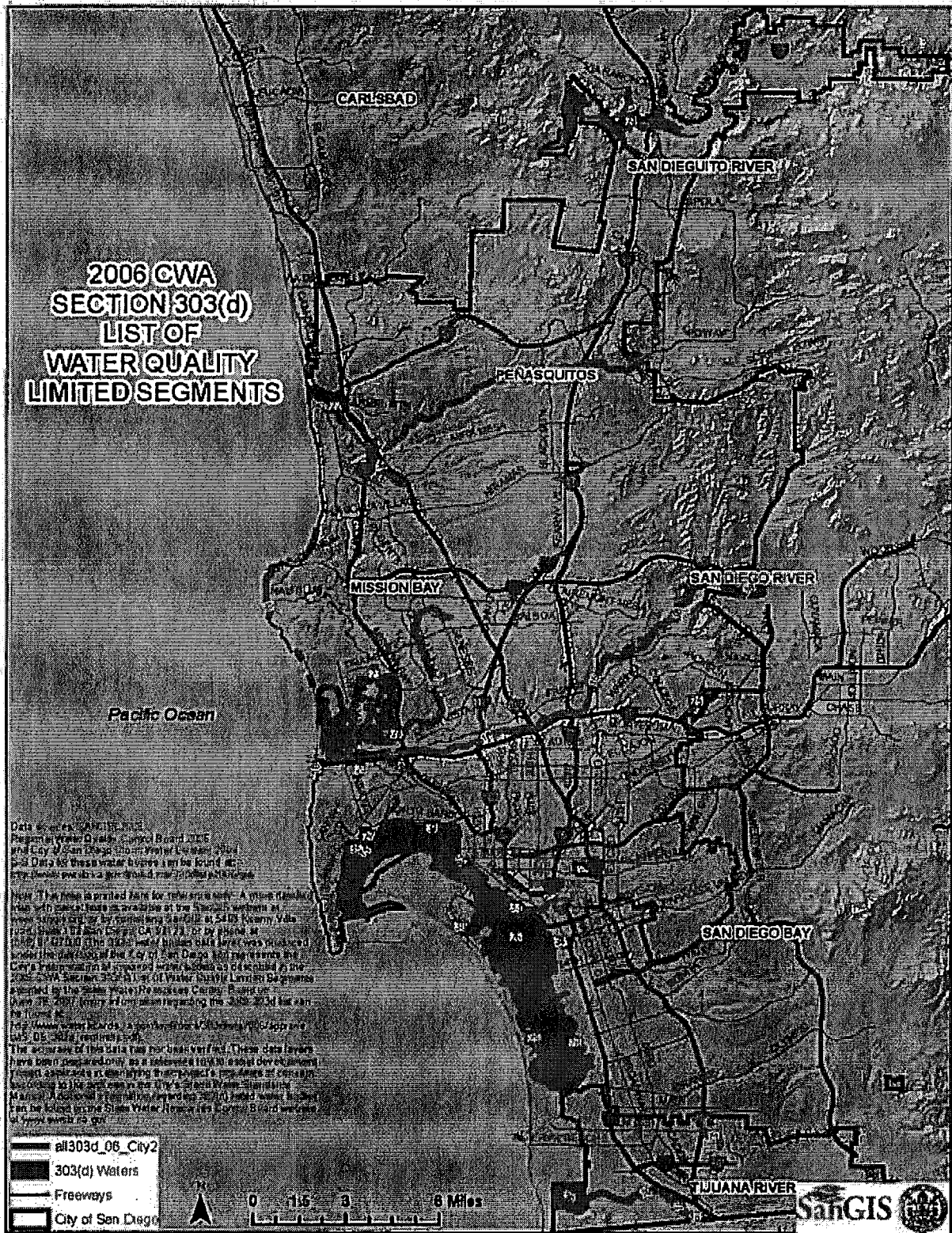


Table 2-2. BENEFICIAL USES OF INLAND SURFACE WATERS

Inland Surface Waters ^{1, 2}	Hydrologic Unit Basin Number	BENEFICIAL USE															
		MUN	AGR	IND	PROC	GR	FRSH	POW	REC1	REC2	BIO	WAR	COL	WILD	RARE	SPWN	
Pueblo San Diego Watershed																	
unnamed intermittent coastal streams	8.10	+								○	●		●		●		
Powerhouse Canyon	8.21	+								○	●		●		●		
→ Chollas Creek ^{3,4}	8.22	+								○	●		●		●		
South Chollas Valley	8.22	+								○	●		●		●		
unnamed intermittent streams	8.31	+								○	●		●		●		
Paradise Creek	8.32	+								○	●		●		●		
Paradise Valley	8.32	+								○	●		●		●		
Sweetwater River Watershed																	
Sweetwater River	9.35	●	●	●	●					●	●		●	●	●		●
Stonewall Creek	9.35	●	●	●	●					●	●		●	●	●		●
Harper Creek	9.35	●	●	●	●					●	●		●	●	●		●
Cold Stream	9.35	●	●	●	●					●	●		●	●	●		●
Japacha Creek	9.35	●	●	●	●					●	●		●	●	●		●
Juaquapin Creek	9.35	●	●	●	●					●	●		●	●	●		●
Arroyo Seco	9.35	●	●	●	●					●	●		●	●	●		●
Sweetwater River	9.34	●	●	●	●					●	●		●	●	●		●

- Existing Beneficial Use
- Potential Beneficial Use
- + Excepted from MUN (See Text)

¹ Waterbodies are listed multiple times if they cross hydrologic area or sub area boundaries.

² Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.

³ Chollas Creek is designated as an impaired water body for copper, lead and zinc pursuant to Clean Water Act Section 303(d). A Total Maximum Daily Load (TMDL) has been adopted to address this impairment. See Chapter 3, Water Quality Objectives for Toxicity and Toxic Pollutants and Chapter 7, Total Maximum Daily Loads

⁴ Aliso Creek, San Juan Creek, Tecolote Creek, Forrester Creek, San Diego River (lower), and Chollas Creek are designated as water quality limited segments for indicator bacteria pursuant to Clean Water Act section 303(d). Total Maximum Daily Loads have been adopted to address these impairments. See Chapter 3, Water Quality Objectives, Bacteria -Total Coliform, Fecal Coliform, E. Coli, and Enterococci, and Chapter 7, Revised Total Maximum Daily Loads for Indicator Bacteria, Project I – Twenty Beaches and Creeks in the San Diego Region (Including Tecolote Creek).

EXHIBIT H

Table 4-3. Structural BMP Treatment Control Selection Matrix

BMP	LID	HMP Control	Sediment	Nutrients	Trash	Metals	Bacteria	Oils and Grease	Organics
Infiltration Basin	Y	Y	H	H	H	H	H	H	H
Bioretention Basin	Y	Y	H	M	H	H	H	H	H
Cistern Plus Bioretention	Y	Y	H	M	H	H	H	H	H
Vault plus Bioretention	Y	Y	H	M	H	H	H	H	H
Self-retaining Area	Y	Y	H	H	H	H	H	H	H
Dry Wells	Y	Y	H	H	H	H	H	H	H
Constructed Wetlands	Y	Y	H	M	H	H	H	H	H
Extended Detention Basin	Y	Y	M	L	H	M	M	M	M
Vegetated Swale	Y	N	M	L	L	M	L	M	M
Vegetated Buffer Strips	Y	N	H	L	M	H	L	H	M
Flow-Through Planter Boxes	Y	Y	H	M	H	H	H	H	H
Vortex Separator or Wet Vault	N	N	M	L	M	L	L	L	L
Media Filter	N	N	H	L	H	H	M	H	H

H High removal efficiency
M Medium removal efficiency
L Low removal efficiency

4.4.2 Restrictions on the Use of Infiltration Treatment BMPs

Treatment control BMPs that are designed to function as infiltration devices shall meet the following conditions (these conditions do not apply to treatment BMPs which allow incidental infiltration and are not designed to function primarily as infiltration devices, such as grassy swales, detention basins, vegetated buffer strips, constructed wetlands, etc.):

- Urban runoff from commercial developments shall undergo pretreatment to remove both physical and chemical contaminants prior to infiltration.
- All dry weather flows shall be diverted from infiltration devices except for those non-storm water discharges authorized pursuant to 40 CFR 122.26(d)(2)(iv)(B)(1):
 - Diverted stream flows
 - Rising ground waters

6" POND

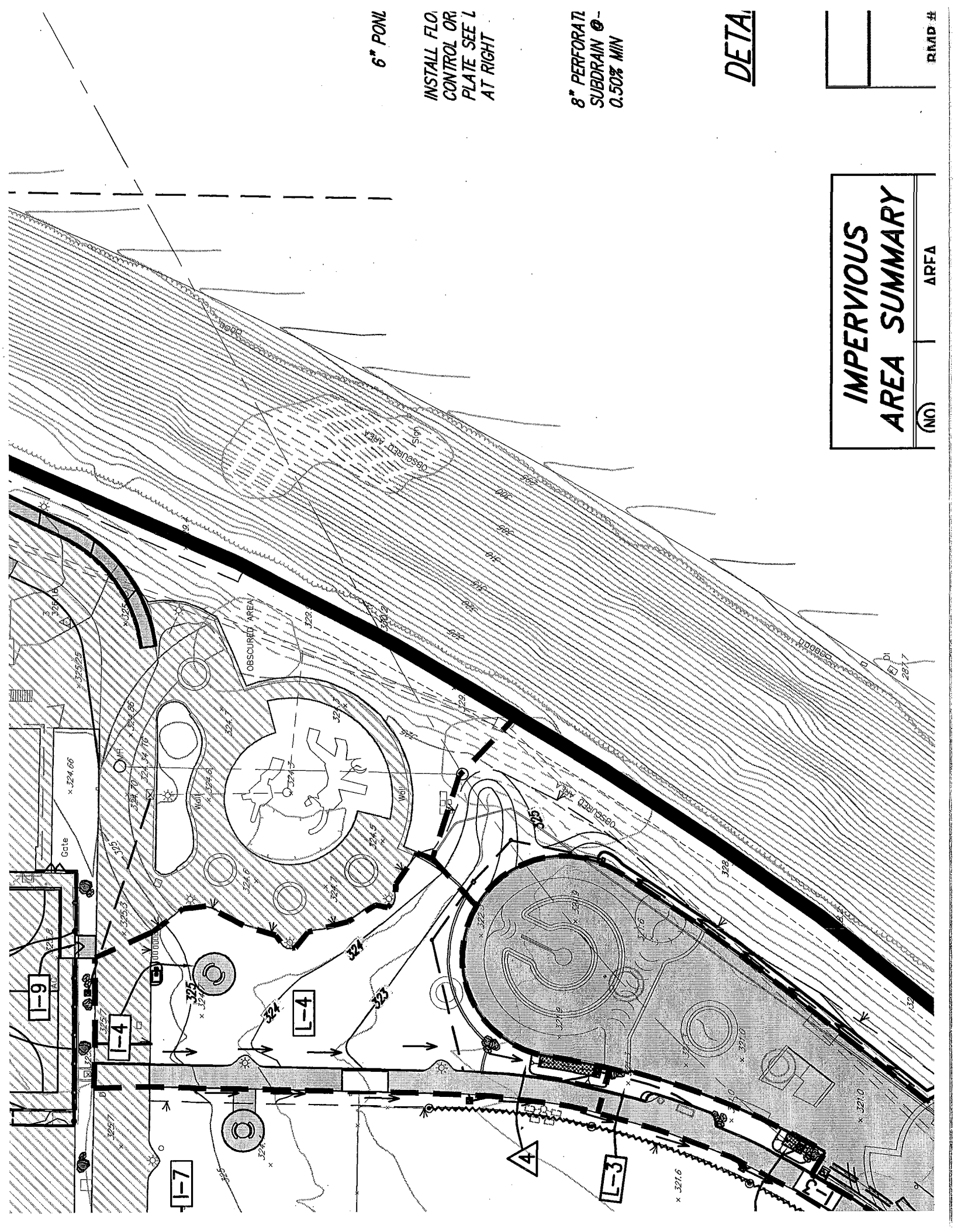
INSTALL FLO.
CONTROL OR
PLATE SEE L
AT RIGHT

8" PERFORATL
SUBDRAIN @ -
0.50% MIN

DETAIL

RMD #

IMPERVIOUS AREA SUMMARY	
(NO)	AREA



Site Design & Landscape Planning SD-10



Design Objectives

- ✓ Maximize Infiltration
- ✓ Provide Retention
- ✓ Slow Runoff
- ✓ Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Each project site possesses unique topographic, hydrologic, and vegetative features, some of which are more suitable for development than others. Integrating and incorporating appropriate landscape planning methodologies into the project design is the most effective action that can be done to minimize surface and groundwater contamination from stormwater.

Approach

Landscape planning should couple consideration of land suitability for urban uses with consideration of community goals and projected growth. Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment.

Design Considerations

Design requirements for site design and landscapes planning should conform to applicable standards and specifications of agencies with jurisdiction and be consistent with applicable General Plan and Local Area Plan policies.



SD-10 Site Design & Landscape Planning

Designing New Installations

Begin the development of a plan for the landscape unit with attention to the following general principles:

- Formulate the plan on the basis of clearly articulated community goals. Carefully identify conflicts and choices between retaining and protecting desired resources and community growth.
- Map and assess land suitability for urban uses. Include the following landscape features in the assessment: wooded land, open unwooded land, steep slopes, erosion-prone soils, foundation suitability, soil suitability for waste disposal, aquifers, aquifer recharge areas, wetlands, floodplains, surface waters, agricultural lands, and various categories of urban land use. When appropriate, the assessment can highlight outstanding local or regional resources that the community determines should be protected (e.g., a scenic area, recreational area, threatened species habitat, farmland, fish run). Mapping and assessment should recognize not only these resources but also additional areas needed for their sustenance.

Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Conserve Natural Areas during Landscape Planning

If applicable, the following items are required and must be implemented in the site layout during the subdivision design and approval process, consistent with applicable General Plan and Local Area Plan policies:

- Cluster development on least-sensitive portions of a site while leaving the remaining land in a natural undisturbed condition.
- Limit clearing and grading of native vegetation at a site to the minimum amount needed to build lots, allow access, and provide fire protection.
- Maximize trees and other vegetation at each site by planting additional vegetation, clustering tree areas, and promoting the use of native and/or drought tolerant plants.
- Promote natural vegetation by using parking lot islands and other landscaped areas.
- Preserve riparian areas and wetlands.

Maximize Natural Water Storage and Infiltration Opportunities Within the Landscape Unit

- Promote the conservation of forest cover. Building on land that is already deforested affects basin hydrology to a lesser extent than converting forested land. Loss of forest cover reduces interception storage, detention in the organic forest floor layer, and water losses by evapotranspiration, resulting in large peak runoff increases and either their negative effects or the expense of countering them with structural solutions.
- Maintain natural storage reservoirs and drainage corridors, including depressions, areas of permeable soils, swales, and intermittent streams. Develop and implement policies and

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regulations to discourage the clearing, filling, and channelization of these features. Utilize them in drainage networks in preference to pipes, culverts, and engineered ditches.

- Evaluating infiltration opportunities by referring to the stormwater management manual for the jurisdiction and pay particular attention to the selection criteria for avoiding groundwater contamination, poor soils, and hydrogeological conditions that cause these facilities to fail. If necessary, locate developments with large amounts of impervious surfaces or a potential to produce relatively contaminated runoff away from groundwater recharge areas.

Protection of Slopes and Channels during Landscape Design

- Convey runoff safely from the tops of slopes.
- Avoid disturbing steep or unstable slopes.
- Avoid disturbing natural channels.
- Stabilize disturbed slopes as quickly as possible.
- Vegetate slopes with native or drought tolerant vegetation.
- Control and treat flows in landscaping and/or other controls prior to reaching existing natural drainage systems.
- Stabilize temporary and permanent channel crossings as quickly as possible, and ensure that increases in run-off velocity and frequency caused by the project do not erode the channel.
- Install energy dissipaters, such as riprap, at the outlets of new storm drains, culverts, conduits, or channels that enter unlined channels in accordance with applicable specifications to minimize erosion. Energy dissipaters shall be installed in such a way as to minimize impacts to receiving waters.
- Line on-site conveyance channels where appropriate, to reduce erosion caused by increased flow velocity due to increases in tributary impervious area. The first choice for linings should be grass or some other vegetative surface, since these materials not only reduce runoff velocities, but also provide water quality benefits from filtration and infiltration. If velocities in the channel are high enough to erode grass or other vegetative linings, riprap, concrete, soil cement, or geo-grid stabilization are other alternatives.
- Consider other design principles that are comparable and equally effective.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of "redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

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Redevelopment may present significant opportunity to add features which had not previously been implemented. Examples include incorporation of depressions, areas of permeable soils, and swales in newly redeveloped areas. While some site constraints may exist due to the status of already existing infrastructure, opportunities should not be missed to maximize infiltration, slow runoff, reduce impervious areas, disconnect directly connected impervious areas.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Stormwater Management Manual for Western Washington, Washington State Department of Ecology, August 2001.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.



Rain Garden

Design Objectives

- ✓ Maximize Infiltration
- ✓ Provide Retention
- ✓ Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- ✓ Contain Pollutants
- Collect and Convey

Description

Various roof runoff controls are available to address stormwater that drains off rooftops. The objective is to reduce the total volume and rate of runoff from individual lots, and retain the pollutants on site that may be picked up from roofing materials and atmospheric deposition. Roof runoff controls consist of directing the roof runoff away from paved areas and mitigating flow to the storm drain system through one of several general approaches: cisterns or rain barrels; dry wells or infiltration trenches; pop-up emitters, and foundation planting. The first three approaches require the roof runoff to be contained in a gutter and downspout system. Foundation planting provides a vegetated strip under the drip line of the roof.

Approach

Design of individual lots for single-family homes as well as lots for higher density residential and commercial structures should consider site design provisions for containing and infiltrating roof runoff or directing roof runoff to vegetative swales or buffer areas. Retained water can be reused for watering gardens, lawns, and trees. Benefits to the environment include reduced demand for potable water used for irrigation, improved stormwater quality, increased groundwater recharge, decreased runoff volume and peak flows, and decreased flooding potential.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment.

Design Considerations

Designing New Installations

Cisterns or Rain Barrels

One method of addressing roof runoff is to direct roof downspouts to cisterns or rain barrels. A cistern is an above ground storage vessel with either a manually operated valve or a permanently open outlet. Roof runoff is temporarily stored and then released for irrigation or infiltration between storms. The number of rain



barrels needed is a function of the rooftop area. Some low impact developers recommend that every house have at least 2 rain barrels, with a minimum storage capacity of 1000 liters. Roof barrels serve several purposes including mitigating the first flush from the roof which has a high volume, amount of contaminants, and thermal load. Several types of rain barrels are commercially available. Consideration must be given to selecting rain barrels that are vector proof and childproof. In addition, some barrels are designed with a bypass valve that filters out grit and other contaminants and routes overflow to a soak-away pit or rain garden.

If the cistern has an operable valve, the valve can be closed to store stormwater for irrigation or infiltration between storms. This system requires continual monitoring by the resident or grounds crews, but provides greater flexibility in water storage and metering. If a cistern is provided with an operable valve and water is stored inside for long periods, the cistern must be covered to prevent mosquitoes from breeding.

A cistern system with a permanently open outlet can also provide for metering stormwater runoff. If the cistern outlet is significantly smaller than the size of the downspout inlet (say $\frac{1}{4}$ to $\frac{1}{2}$ inch diameter), runoff will build up inside the cistern during storms, and will empty out slowly after peak intensities subside. This is a feasible way to mitigate the peak flow increases caused by rooftop impervious land coverage, especially for the frequent, small storms.

Dry wells and Infiltration Trenches

Roof downspouts can be directed to dry wells or infiltration trenches. A dry well is constructed by excavating a hole in the ground and filling it with an open graded aggregate, and allowing the water to fill the dry well and infiltrate after the storm event. An underground connection from the downspout conveys water into the dry well, allowing it to be stored in the voids. To minimize sedimentation from lateral soil movement, the sides and top of the stone storage matrix can be wrapped in a permeable filter fabric, though the bottom may remain open. A perforated observation pipe can be inserted vertically into the dry well to allow for inspection and maintenance.

In practice, dry wells receiving runoff from single roof downspouts have been successful over long periods because they contain very little sediment. They must be sized according to the amount of rooftop runoff received, but are typically 4 to 5 feet square, and 2 to 3 feet deep, with a minimum of 1-foot soil cover over the top (maximum depth of 10 feet).

To protect the foundation, dry wells must be set away from the building at least 10 feet. They must be installed in solids that accommodate infiltration. In poorly drained soils, dry wells have very limited feasibility.

Infiltration trenches function in a similar manner and would be particularly effective for larger roof areas. An infiltration trench is a long, narrow, rock-filled trench with no outlet that receives stormwater runoff. These are described under Treatment Controls.

Pop-up Drainage Emitter

Roof downspouts can be directed to an underground pipe that daylight some distance from the building foundation, releasing the roof runoff through a pop-up emitter. Similar to a pop-up irrigation head, the emitter only opens when there is flow from the roof. The emitter remains flush to the ground during dry periods, for ease of lawn or landscape maintenance.

Foundation Planting

Landscape planting can be provided around the base to allow increased opportunities for stormwater infiltration and protect the soil from erosion caused by concentrated sheet flow coming off the roof. Foundation plantings can reduce the physical impact of water on the soil and provide a subsurface matrix of roots that encourage infiltration. These plantings must be sturdy enough to tolerate the heavy runoff sheet flows, and periodic soil saturation.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of "redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Supplemental Information

Examples

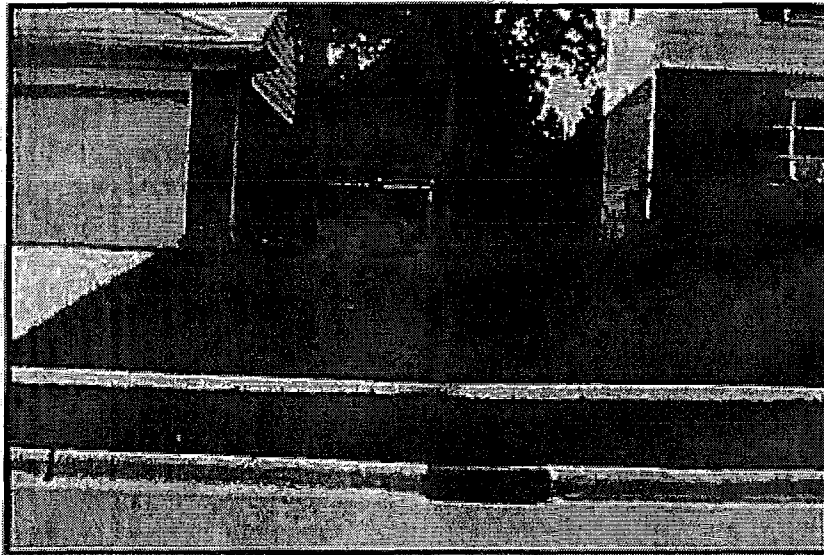
- City of Ottawa's Water Links Surface –Water Quality Protection Program
- City of Toronto Downspout Disconnection Program
- City of Boston, MA, Rain Barrel Demonstration Program

Other Resources

Hager, Marty Catherine, Stormwater, "Low-Impact Development", January/February 2003.
www.stormh2o.com

Low Impact Urban Design Tools, Low Impact Development Design Center, Beltsville, MD.
www.lid-stormwater.net

Start at the Source, Bay Area Stormwater Management Agencies Association, 1999 Edition



Design Objectives

- ✓ Maximize Infiltration
- ✓ Provide Retention
- ✓ Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Irrigation water provided to landscaped areas may result in excess irrigation water being conveyed into stormwater drainage systems.

Approach

Project plan designs for development and redevelopment should include application methods of irrigation water that minimize runoff of excess irrigation water into the stormwater conveyance system.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations

Designing New Installations

The following methods to reduce excessive irrigation runoff should be considered, and incorporated and implemented where determined applicable and feasible by the Permittee:

- Employ rain-triggered shutoff devices to prevent irrigation after precipitation.
- Design irrigation systems to each landscape area's specific water requirements.
- Include design featuring flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines.
- Implement landscape plans consistent with County or City water conservation resolutions, which may include provision of water sensors, programmable irrigation times (for short cycles), etc.



- Design timing and application methods of irrigation water to minimize the runoff of excess irrigation water into the storm water drainage system.
- Group plants with similar water requirements in order to reduce excess irrigation runoff and promote surface filtration. Choose plants with low irrigation requirements (for example, native or drought tolerant species). Consider design features such as:
 - Using mulches (such as wood chips or bar) in planter areas without ground cover to minimize sediment in runoff
 - Installing appropriate plant materials for the location, in accordance with amount of sunlight and climate, and use native plant materials where possible and/or as recommended by the landscape architect
 - Leaving a vegetative barrier along the property boundary and interior watercourses, to act as a pollutant filter, where appropriate and feasible
 - Choosing plants that minimize or eliminate the use of fertilizer or pesticides to sustain growth
- Employ other comparable, equally effective methods to reduce irrigation water runoff.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of "redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Other Resources

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Design Objectives

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- Provide Retention
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- Minimize Impervious Land Coverage
- ✓ Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Waste materials dumped into storm drain inlets can have severe impacts on receiving and ground waters. Posting notices regarding discharge prohibitions at storm drain inlets can prevent waste dumping. Storm drain signs and stencils are highly visible source controls that are typically placed directly adjacent to storm drain inlets.

Approach

The stencil or affixed sign contains a brief statement that prohibits dumping of improper materials into the urban runoff conveyance system. Storm drain messages have become a popular method of alerting the public about the effects of and the prohibitions against waste disposal.

Suitable Applications

Stencils and signs alert the public to the destination of pollutants discharged to the storm drain. Signs are appropriate in residential, commercial, and industrial areas, as well as any other area where contributions or dumping to storm drains is likely.

Design Considerations

Storm drain message markers or placards are recommended at all storm drain inlets within the boundary of a development project. The marker should be placed in clear sight facing toward anyone approaching the inlet from either side. All storm drain inlet locations should be identified on the development site map.

Designing New Installations

The following methods should be considered for inclusion in the project design and show on project plans:

- Provide stenciling or labeling of all storm drain inlets and catch basins, constructed or modified, within the project area with prohibitive language. Examples include "NO DUMPING –



DRAINS TO OCEAN" and/or other graphical icons to discourage illegal dumping.

- Post signs with prohibitive language and/or graphical icons, which prohibit illegal dumping at public access points along channels and creeks within the project area.

Note - Some local agencies have approved specific signage and/or storm drain message placards for use. Consult local agency stormwater staff to determine specific requirements for placard types and methods of application.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. If the project meets the definition of "redevelopment", then the requirements stated under "designing new installations" above should be included in all project design plans.

Additional Information

Maintenance Considerations

- Legibility of markers and signs should be maintained. If required by the agency with jurisdiction over the project, the owner/operator or homeowner's association should enter into a maintenance agreement with the agency or record a deed restriction upon the property title to maintain the legibility of placards or signs.

Placement

- Signage on top of curbs tends to weather and fade.
- Signage on face of curbs tends to be worn by contact with vehicle tires and sweeper brooms.

Supplemental Information

Examples

- Most MS4 programs have storm drain signage programs. Some MS4 programs will provide stencils, or arrange for volunteers to stencil storm drains as part of their outreach program.

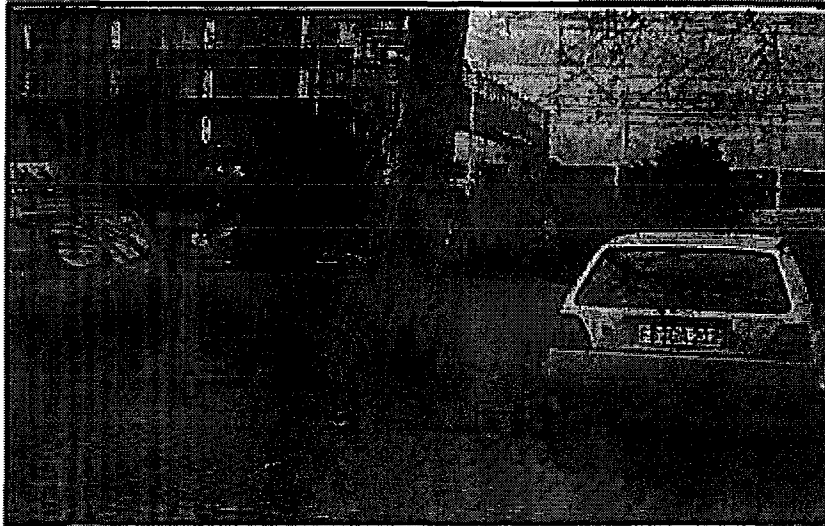
Other Resources

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Description

Pervious paving is used for light vehicle loading in parking areas. The term describes a system comprising a load-bearing, durable surface together with an underlying layered structure that temporarily stores water prior to infiltration or drainage to a controlled outlet. The surface can itself be porous such that water infiltrates across the entire surface of the material (e.g., grass and gravel surfaces, porous concrete and porous asphalt), or can be built up of impermeable blocks separated by spaces and joints, through which the water can drain. This latter system is termed 'permeable' paving. Advantages of pervious pavements is that they reduce runoff volume while providing treatment, and are unobtrusive resulting in a high level of acceptability.

Approach

Attenuation of flow is provided by the storage within the underlying structure or sub base, together with appropriate flow controls. An underlying geotextile may permit groundwater recharge, thus contributing to the restoration of the natural water cycle. Alternatively, where infiltration is inappropriate (e.g., if the groundwater vulnerability is high, or the soil type is unsuitable), the surface can be constructed above an impermeable membrane. The system offers a valuable solution for drainage of spatially constrained urban areas.

Significant attenuation and improvement in water quality can be achieved by permeable pavements, whichever method is used. The surface and subsurface infrastructure can remove both the soluble and fine particulate pollutants that occur within urban runoff. Roof water can be piped into the storage area directly, adding areas from which the flow can be attenuated. Also, within lined systems, there is the opportunity for stored runoff to be piped out for reuse.

Suitable Applications

Residential, commercial and industrial applications are possible. The use of permeable pavement may be restricted in cold regions, arid regions or regions with high wind erosion. There are some specific disadvantages associated with permeable pavement, which are as follows:

- Permeable pavement can become clogged if improperly installed or maintained. However, this is countered by the ease with which small areas of paving can be cleaned or replaced when blocked or damaged.

- Their application should be limited to highways with low traffic volumes, axle loads and speeds (less than 30 mph limit), car parking areas and other lightly trafficked or non-trafficked areas. Permeable surfaces are currently not considered suitable for adoptable roads due to the risks associated with failure on high speed roads, the safety implications of ponding, and disruption arising from reconstruction.
- When using un-lined, infiltration systems, there is some risk of contaminating groundwater, depending on soil conditions and aquifer susceptibility. However, this risk is likely to be small because the areas drained tend to have inherently low pollutant loadings.
- The use of permeable pavement is restricted to gentle slopes.
- Porous block paving has a higher risk of abrasion and damage than solid blocks.

Design Considerations

Designing New Installations

If the grades, subsoils, drainage characteristics, and groundwater conditions are suitable, permeable paving may be substituted for conventional pavement on parking areas, cul de sacs and other areas with light traffic. Slopes should be flat or very gentle. Scottish experience has shown that permeable paving systems can be installed in a wide range of ground conditions, and the flow attenuation performance is excellent even when the systems are lined.

The suitability of a pervious system at a particular pavement site will, however, depend on the loading criteria required of the pavement.

Where the system is to be used for infiltrating drainage waters into the ground, the vulnerability of local groundwater sources to pollution from the site should be low, and the seasonal high water table should be at least 4 feet below the surface.

Ideally, the pervious surface should be horizontal in order to intercept local rainfall at source. On sloping sites, pervious surfaces may be terraced to accommodate differences in levels.

Design Guidelines

The design of each layer of the pavement must be determined by the likely traffic loadings and their required operational life. To provide satisfactory performance, the following criteria should be considered:

- The subgrade should be able to sustain traffic loading without excessive deformation.
- The granular capping and sub-base layers should give sufficient load-bearing to provide an adequate construction platform and base for the overlying pavement layers.
- The pavement materials should not crack or suffer excessive rutting under the influence of traffic. This is controlled by the horizontal tensile stress at the base of these layers.

There is no current structural design method specifically for pervious pavements. Allowances should be considered the following factors in the design and specification of materials:

- Pervious pavements use materials with high permeability and void space. All the current UK pavement design methods are based on the use of conventional materials that are dense and relatively impermeable. The stiffness of the materials must therefore be assessed.
- Water is present within the construction and can soften and weaken materials, and this must be allowed for.
- Existing design methods assume full friction between layers. Any geotextiles or geomembranes must be carefully specified to minimize loss of friction between layers.
- Porous asphalt loses adhesion and becomes brittle as air passes through the voids. Its durability is therefore lower than conventional materials.

The single sized grading of materials used means that care should be taken to ensure that loss of finer particles between unbound layers does not occur.

Positioning a geotextile near the surface of the pervious construction should enable pollutants to be trapped and retained close to the surface of the construction. This has both advantages and disadvantages. The main disadvantage is that the filtering of sediments and their associated pollutants at this level may hamper percolation of waters and can eventually lead to surface ponding. One advantage is that even if eventual maintenance is required to reinstate infiltration, only a limited amount of the construction needs to be disturbed, since the sub-base below the geotextile is protected. In addition, the pollutant concentration at a high level in the structure allows for its release over time. It is slowly transported in the stormwater to lower levels where chemical and biological processes may be operating to retain or degrade pollutants.

The design should ensure that sufficient void space exists for the storage of sediments to limit the period between remedial works.

- Pervious pavements require a single size grading to give open voids. The choice of materials is therefore a compromise between stiffness, permeability and storage capacity.
- Because the sub-base and capping will be in contact with water for a large part of the time, the strength and durability of the aggregate particles when saturated and subjected to wetting and drying should be assessed.
- A uniformly graded single size material cannot be compacted and is liable to move when construction traffic passes over it. This effect can be reduced by the use of angular crushed rock material with a high surface friction.

In pollution control terms, these layers represent the site of long term chemical and biological pollutant retention and degradation processes. The construction materials should be selected, in addition to their structural strength properties, for their ability to sustain such processes. In general, this means that materials should create neutral or slightly alkaline conditions and they should provide favorable sites for colonization by microbial populations.

Construction/Inspection Considerations

- Permeable surfaces can be laid without cross-falls or longitudinal gradients.
- The blocks should be lain level

- They should not be used for storage of site materials, unless the surface is well protected from deposition of silt and other spillages.
- The pavement should be constructed in a single operation, as one of the last items to be built, on a development site. Landscape development should be completed before pavement construction to avoid contamination by silt or soil from this source.
- Surfaces draining to the pavement should be stabilized before construction of the pavement.
- Inappropriate construction equipment should be kept away from the pavement to prevent damage to the surface, sub-base or sub-grade.

Maintenance Requirements

The maintenance requirements of a pervious surface should be reviewed at the time of design and should be clearly specified. Maintenance is required to prevent clogging of the pervious surface. The factors to be considered when defining maintenance requirements must include:

- Type of use
- Ownership
- Level of trafficking
- The local environment and any contributing catchments

Studies in the UK have shown satisfactory operation of porous pavement systems without maintenance for over 10 years and recent work by Imbe et al. at 9th ICUD, Portland, 2002 describes systems operating for over 20 years without maintenance. However, performance under such regimes could not be guaranteed, Table 1 shows typical recommended maintenance regimes:

Activity	Schedule
<ul style="list-style-type: none"> ■ Minimize use of salt or grit for de-icing ■ Keep landscaped areas well maintained ■ Prevent soil being washed onto pavement 	Ongoing
<ul style="list-style-type: none"> ■ Vacuum clean surface using commercially available sweeping machines at the following times: <ul style="list-style-type: none"> - End of winter (April) - Mid-summer (July / August) - After Autumn leaf-fall (November) 	2/3 x per year
<ul style="list-style-type: none"> ■ Inspect outlets 	Annual
<ul style="list-style-type: none"> ■ If routine cleaning does not restore infiltration rates, then reconstruction of part of the whole of a pervious surface may be required. ■ The surface area affected by hydraulic failure should be lifted for inspection of the internal materials to identify the location and extent of the blockage. ■ Surface materials should be lifted and replaced after brush cleaning. Geotextiles may need complete replacement. ■ Sub-surface layers may need cleaning and replacing. ■ Removed silts may need to be disposed of as controlled waste. 	As needed (infrequent) Maximum 15-20 years

Permeable pavements are up to 25 % cheaper (or at least no more expensive than the traditional forms of pavement construction), when all construction and drainage costs are taken into account. (Accepting that the porous asphalt itself is a more expensive surfacing, the extra cost of which is offset by the savings in underground pipework etc.) (Niemczynowicz, et al., 1987)

Table 1 gives US cost estimates for capital and maintenance costs of porous pavements (Landphair et al., 2000)

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of "redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Additional Information*Cost Considerations*

Permeable pavements are up to 25 % cheaper (or at least no more expensive than the traditional forms of pavement construction), when all construction and drainage costs are taken into account. (Accepting that the porous asphalt itself is a more expensive surfacing, the extra cost of which is offset by the savings in underground pipework etc.) (Niemczynowicz, et al., 1987)

Table 2 gives US cost estimates for capital and maintenance costs of porous pavements (Landphair et al., 2000)

Table 2 Engineer's Estimate for Porous Pavement

Porous Pavement													
Item	Units	Price	Cycles/Year	Quant. 1 Acre WS	Total	Quant. 2 Acre WS	Total	Quant. 3 Acre WS	Total	Quant. 4 Acre WS	Total	Quant. 5 Acre WS	Total
Grading	SY	\$2.00		604	\$1,208	1209	\$2,418	1812	\$3,624	2419	\$4,838	3020	\$6,040
Paving	SY	\$19.00		212	\$4,028	424	\$8,056	636	\$12,084	848	\$16,112	1060	\$20,140
Excavation	CY	\$3.60		201	\$724	403	\$1,451	604	\$2,174	806	\$2,902	1008	\$3,629
Filter Fabric	SY	\$1.15		700	\$805	1400	\$1,610	2000	\$2,300	2800	\$3,220	3600	\$4,140
Stone Fill	CY	\$16.00		201	\$3,216	403	\$6,448	604	\$9,664	806	\$12,896	1008	\$16,128
Sand	CY	\$7.00		100	\$700	200	\$1,400	300	\$2,100	400	\$2,800	500	\$3,500
Sight Well	EA	\$300.00		2	\$600	3	\$900	4	\$1,200	7	\$2,100	7	\$2,100
Seeding	LF	\$0.05		644	\$32	1288	\$64	1932	\$97	2576	\$129	3220	\$161
Check Dam	CY	\$35.00		0	\$0	0	\$0	0	\$0	0	\$0	0	\$0
Total Construction Costs							\$10,105		\$19,929		\$29,619		\$40,158
Construction Costs Amortized for 20 Years							\$505		\$996		\$1,481		\$2,490
Annual Maintenance Expense													
Item	Units	Price	Cycles/Year	Quant. 1 Acre WS	Total	Quant. 2 Acre WS	Total	Quant. 3 Acre WS	Total	Quant. 4 Acre WS	Total	Quant. 5 Acre WS	Total
Sweeping	AC	\$250.00	6	1	\$1,500	2	\$3,000	3	\$4,500	4	\$6,000	5	\$7,500
Washing	AC	\$250.00	6	1	\$1,500	2	\$3,000	3	\$4,500	4	\$6,000	5	\$7,500
Inspection	MH	\$20.00	5	5	\$100	5	\$100	5	\$100	5	\$100	5	\$100
Deep Clean	AC	\$450.00	0.5	1	\$225	2	\$450	3	\$675	3.9	\$878	5	\$1,125
Total Annual Maintenance Expense							\$3,980		\$7,792		\$11,651		\$15,483

Supplemental Information**Other Resources**

Abbott C.L. and Comino-Mateos L. 2001. *In situ performance monitoring of an infiltration drainage system and field testing of current design procedures*. Journal CIWEM, 15(3), pp.198-202.

Construction Industry Research and Information Association (CIRIA). 2002. *Source Control using Constructed Pervious Surfaces C582*, London, SW1P 3AU.

Construction Industry Research and Information Association (CIRIA). 2000. *Sustainable urban drainage systems - design manual for Scotland and Northern Ireland Report C521*, London, SW1P 3AU.

Construction Industry Research and Information Association (CIRIA). 2000 C522 *Sustainable urban drainage systems - design manual for England and Wales*, London, SW1P 3AU.

Construction Industry Research and Information Association (CIRIA). *RP448 Manual of good practice for the design, construction and maintenance of infiltration drainage systems for stormwater runoff control and disposal*, London, SW1P 3AU.

Dierkes C., Kuhlmann L., Kandasamy J. & Angelis G. *Pollution Retention Capability and Maintenance of Permeable Pavements*. Proc 9th International Conference on Urban Drainage, Portland Oregon, September 2002.

Hart P (2002) *Permeable Paving as a Stormwater Source Control System*. Paper presented at Scottish Hydraulics Study Group 14th Annual seminar, SUDS. 22 March 2002, Glasgow.

Kobayashi M., 1999. *Stormwater runoff control in Nagoya City*. Proc. 8 th Int. Conf. on Urban Storm Drainage, Sydney, Australia, pp.825-833.

Landphair, H., McFalls, J., Thompson, D., 2000, *Design Methods, Selection, and Cost Effectiveness of Stormwater Quality Structures*, Texas Transportation Institute Research Report 1837-1, College Station, Texas.

Legret M, Colandini V, *Effects of a porous pavement with reservoir structure on runoff water: water quality and the fate of heavy metals*. Laboratoire Central Des Ponts et Chaussées

Macdonald K. & Jefferies C. *Performance Comparison of Porous Paved and Traditional Car Parks*. Proc. First National Conference on Sustainable Drainage Systems, Coventry June 2001.

Niemczynowicz J, Hogland W, 1987: *Test of porous pavements performed in Lund, Sweden*, in Topics in Drainage Hydraulics and Hydrology. BC. Yen (Ed.), pub. Int. Assoc. For Hydraulic Research, pp 19-80.

Pratt C.J. *SUSTAINABLE URBAN DRAINAGE – A Review of published material on the performance of various SUDS devices prepared for the UK Environment Agency*. Coventry University, UK December 2001.

Pratt C.J., 1995. Infiltration drainage – case studies of UK practice. Project Report

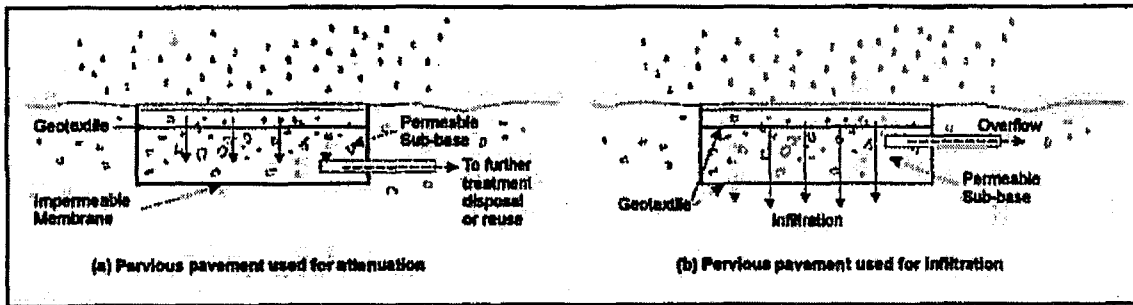
22, Construction Industry Research and Information Association, London, SW1P 3AU; also known as National Rivers Authority R & D Note 485

Pratt. C. J., 1990. Permeable Pavements for Stormwater Quality Enhancement. In: Urban Stormwater Quality Enhancement - Source Control, retrofitting and combined sewer technology, Ed. H.C. Torno, ASCE, ISBN 087262 7594, pp. 131-155

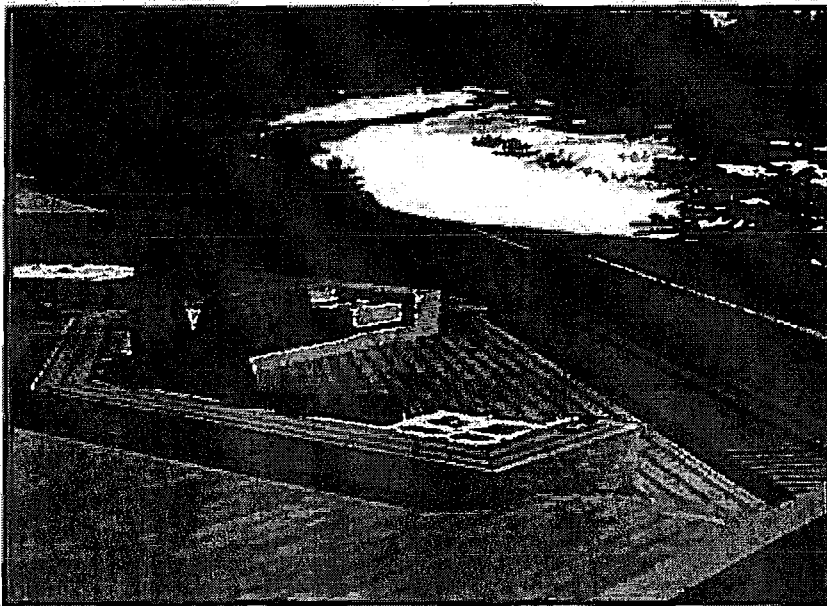
Raimbault G., 1997 French Developments in Reservoir Structures Sustainable water resources I the 21st century. Malmo Sweden

Schlüter W. & Jefferies C. Monitoring the outflow from a *Porous Car Park Proc. First National Conference on Sustainable Drainage Systems, Coventry June 2001.*

Wild, T.C., Jefferies, C., and D'Arcy, B.J. SUDS in Scotland – the Scottish SUDS database Report No SR(02)09 *Scotland and Northern Ireland Forum for Environmental Research, Edinburgh.* In preparation August 2002.



Schematics of a Pervious Pavement System



Design Objectives

- ✓ Maximize Infiltration
- ✓ Provide Retention
- ✓ Source Control
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- Contain Pollutant
- Collect and Convey

Description

Alternative building materials are selected instead of conventional materials for new construction and renovation. These materials reduce potential sources of pollutants in stormwater runoff by eliminating compounds that can leach into runoff, reducing the need for pesticide application, reducing the need for painting and other maintenance, or by reducing the volume of runoff.

Approach

Alternative building materials are available for use as lumber for decking, roofing materials, home siding, and paving for driveways, decks, and sidewalks.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment.

Design Considerations

Designing New Installations

Decking

One of the most common materials for construction of decks and other outdoor construction has traditionally been pressure treated wood, which is now being phased out. The standard treatment is called CCA, for chromated copper arsenate. The key ingredients are arsenic (which kills termites, carpenter ants and other insects), copper (which kills the fungi that cause wood to rot) and chromium (which reacts with the other ingredients to bind them to the wood). The amount of arsenic is far from trivial. A deck just 8 feet x 10 feet contains more than 1 1/3 pounds of this highly potent poison. Replacement materials include a new type of pressure treated wood, plastic and composite lumber.

There are currently over 20 products in the market consisting of plastic or plastic-wood composites. Plastic lumber is made from 100% recycled plastic, # 2 HDPE and polyethylene plastic milk jugs



and soap bottles. Plastic-wood composites are a combination of plastic and wood fibers or sawdust. These materials are a long lasting exterior weather, insect, and chemical resistant wood lumber replacement for non structural applications. Use it for decks, docks, raised garden beds and planter boxes, pallets, hand railings, outdoor furniture, animal pens, boat decks, etc.

New pressure treated wood uses a much safer recipe, ACQ, which stands for ammoniacal copper quartenary. It contains no arsenic and no chromium. Yet the American Wood Preservers Association has found it to be just as effective as the standard formula. ACQ is common in Japan and Europe.

Roofing

Several studies have indicated that metal used as roofing material, flashing, or gutters can leach metals into the environment. The leaching occurs because rainfall is slightly acidic and slowly dissolved the exposed metals. Common traditional applications include copper sheathing and galvanized (zinc) gutters.

Coated metal products are available for both roofing and gutter applications. These products eliminate contact of bare metal with rainfall, eliminating one source of metals in runoff. There are also roofing materials made of recycled rubber and plastic that resemble traditional materials.

A less traditional approach is the use of green roofs. These roofs are not just green, they're alive. Planted with grasses and succulents, low-profile green roofs reduce the urban heat island effect, stormwater runoff, and cooling costs, while providing wildlife habitat and a connection to nature for building occupants. These roofs are widely used on industrial facilities in Europe and have been established as experimental installations in several locations in the US, including Portland, Oregon. Their feasibility is questionable in areas of California with prolonged, dry, hot weather.

Paved Areas

Traditionally, concrete is used for construction of patios, sidewalks, and driveways. Although it is non-toxic, these paved areas reduce stormwater infiltration and increase the volume and rate of runoff. This increase in the amount of runoff is the leading cause of stream channel degradation in urban areas.

There are a number of alternative materials that can be used in these applications, including porous concrete and asphalt, modular blocks, and crushed granite. These materials, especially modular paving blocks, are widely available and a well established method to reduce stormwater runoff.

Building Siding

Wood siding is commonly used on the exterior of residential construction. This material weathers fairly rapidly and requires repeated painting to prevent rotting. Alternative "new" products for this application include cement-fiber and vinyl. Cement-fiber siding is a masonry product made from Portland cement, sand, and cellulose and will not burn, cup, swell, or shrink.

Pesticide Reduction

A common use of powerful pesticides is for the control of termites. Chlordane was used for many years for this purpose and is now found in urban streams and lakes nationwide. There are a

number of physical barriers that can be installed during construction to help reduce the use of pesticides.

Sand barriers for subterranean termites are a physical deterrent because the termites cannot tunnel through it. Sand barriers can be applied in crawl spaces under pier and beam foundations, under slab foundations, and between the foundation and concrete porches, terraces, patios and steps. Other possible locations include under fence posts, underground electrical cables, water and gas lines, telephone and electrical poles, inside hollow tile cells and against retaining walls.

Metal termite shields are physical barriers to termites which prevent them from building invisible tunnels. In reality, metal shields function as a helpful termite detection device, forcing them to build tunnels on the outside of the shields which are easily seen. Metal termite shields also help prevent dampness from wicking to adjoining wood members which can result in rot, thus making the material more attractive to termites and other pests. Metal flashing and metal plates can also be used as a barrier between piers and beams of structures such as decks, which are particularly vulnerable to termite attack.

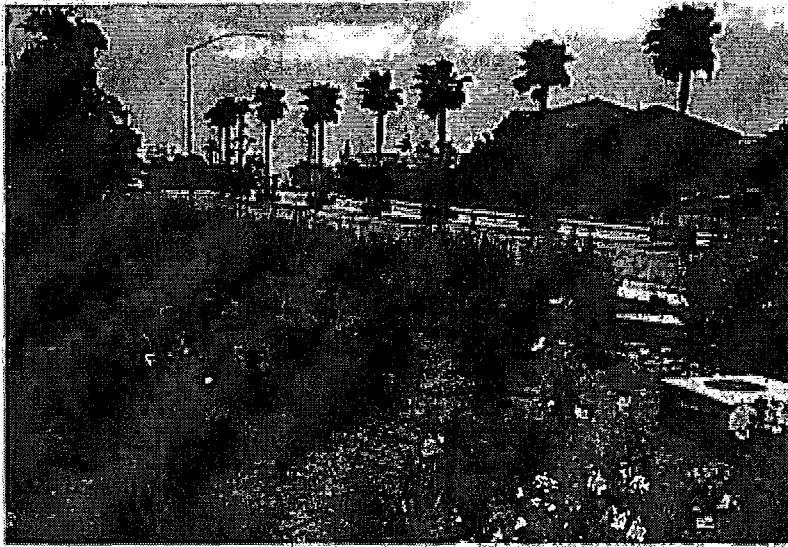
Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of "redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Other Resources

There are no good, independent, comprehensive sources of information on alternative building materials for use in minimizing the impacts of stormwater runoff. Most websites or other references to "green" or "alternative" building materials focus on indoor applications, such as formaldehyde free plywood and low VOC paints, carpets, and pads. Some supplemental information on alternative materials is available from the manufacturers.

Fires are a source of concern in many areas of California. Information on the flammability of alternative decking materials is available from the University of California Forest Product Laboratory (UCFPL) website at: <http://www.ucfpl.ucop.edu/WDDeckIntro.htm>



Location: 43rd Street and Logan Avenue, San Diego, California

MS4 Permit Category

Biofiltration

Manual Category

Biofiltration

Applicable Performance Standard

Pollutant Control

Flow Control

Primary Benefits

Treatment

Volume Reduction (Incidental)

Peak Flow Attenuation (Optional)

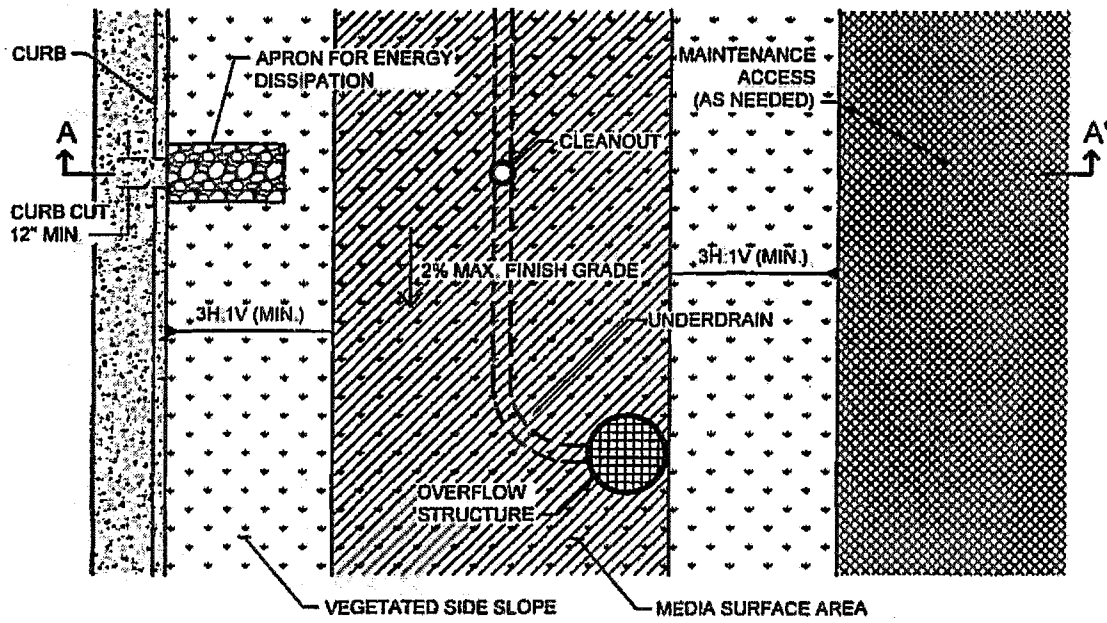
Description

Biofiltration (Bioretention with underdrain) facilities are vegetated surface water systems that filter water through vegetation, and soil or engineered media prior to discharge via underdrain or overflow to the downstream conveyance system. Bioretention with underdrain facilities are commonly incorporated into the site within parking lot landscaping, along roadsides, and in open spaces. Because these types of facilities have limited or no infiltration, they are typically designed to provide enough hydraulic head to move flows through the underdrain connection to the storm drain system. Treatment is achieved through filtration, sedimentation, sorption, biochemical processes and plant uptake.

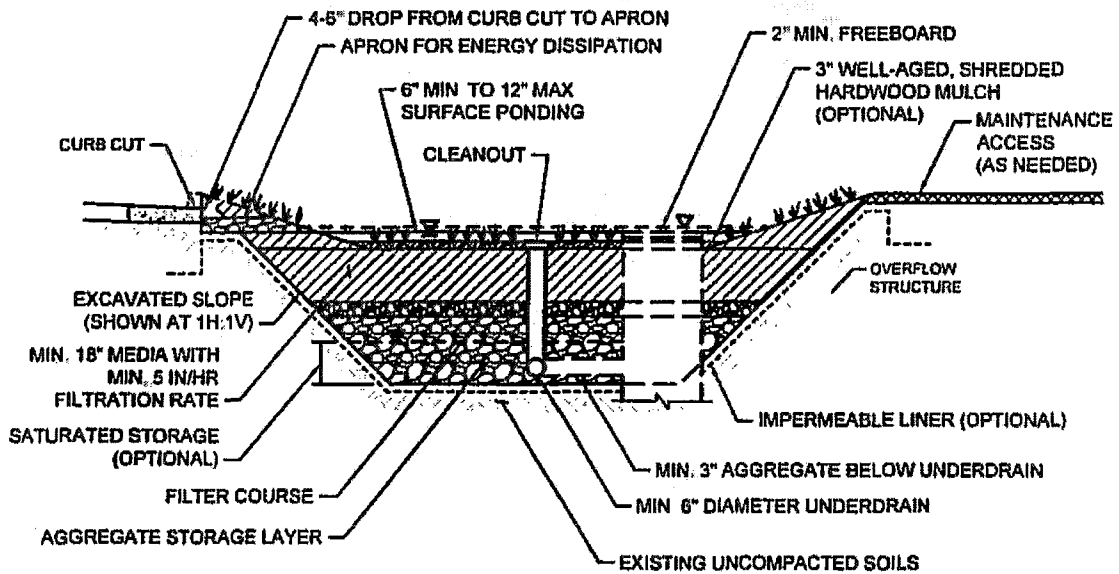
Typical bioretention with underdrain components include:

- Inflow distribution mechanisms (e.g. perimeter flow spreader or filter strips)
- Energy dissipation mechanism for concentrated inflows (e.g., splash blocks or riprap)
- Shallow surface ponding for captured flows
- Side slope and basin bottom vegetation selected based on expected climate and ponding depth
- Non-floating mulch layer (Optional)
- Media layer (planting mix or engineered media) capable of supporting vegetation growth
- Filter course layer consisting of aggregate to prevent the migration of fines into uncompacted native soils or the aggregate storage layer
- Aggregate storage layer with underdrain(s)
- Impermeable liner or uncompacted native soils at the bottom of the facility

- Overflow structure



PLAN
NOT TO SCALE



SECTION A-A'
NOT TO SCALE

Typical plan and Section view of a Biofiltration BMP

Design Adaptations for Project Goals

Biofiltration Treatment BMP for storm water pollutant control. The system is lined or un-lined to provide incidental infiltration, and an underdrain is provided at the bottom to carry away filtered runoff. This configuration is considered to provide biofiltration treatment via flow through the media layer. Storage provided above the underdrain within surface ponding, media, and aggregate storage is considered included in the biofiltration treatment volume. Saturated storage within the aggregate storage layer can be added to this design by raising the underdrain above the bottom of the aggregate storage layer or via an internal weir structure designed to maintain a specific water level elevation.

Integrated storm water flow control and pollutant control configuration. The system can be designed to provide flow rate and duration control by primarily providing increased surface ponding and/or having a deeper aggregate storage layer above the underdrain. This will allow for significant detention storage, which can be controlled via inclusion of an outlet structure at the downstream end of the underdrain.

Design Criteria and Considerations

Bioretention with underdrain must meet the following design criteria. Deviations from the below criteria may be approved at the discretion of the [City Engineer] if it is determined to be appropriate:

<i>Siting and Design</i>	<i>Intent/Rationale</i>
<input type="checkbox"/> Placement observes geotechnical recommendations regarding potential hazards (e.g., slope stability, landslides, liquefaction zones) and setbacks (e.g., slopes, foundations, utilities).	Must not negatively impact existing site geotechnical concerns.
<input type="checkbox"/> An impermeable liner or other hydraulic restriction layer is included if site constraints indicate that infiltration or lateral flows should not be allowed.	Lining prevents storm water from impacting groundwater and/or sensitive environmental or geotechnical features. Incidental infiltration, when allowable, can aid in pollutant removal and groundwater recharge.
<input type="checkbox"/> Contributing tributary area shall be ≤ 5 acres (≤ 1 acre preferred).	Bigger BMPs require additional design features for proper performance. Contributing tributary area greater than 5 acres may be allowed at the discretion of the [City Engineer] if the following conditions are met: 1) incorporate design features (e.g. flow spreaders) to

<i>Siting and Design</i>	<i>Intent/Rationale</i>
<input type="checkbox"/> Finish grade of the facility is $\leq 2\%$.	minimizing short circuiting of flows in the BMP and 2) incorporate additional design features requested by the [City Engineer] for proper performance of the regional BMP. Flatter surfaces reduce erosion and channelization within the facility.
<i>Surface Ponding</i>	
<input type="checkbox"/> Surface ponding is limited to a 24-hour drawdown time.	Surface ponding limited to 24 hour for plant health.
<input type="checkbox"/> Surface ponding depth is ≥ 6 and ≤ 12 inches.	Surface ponding capacity lowers subsurface storage requirements. Deep surface ponding raises safety concerns. Surface ponding depth greater than 12 inches (for additional pollutant control or surface outlet structures or flow-control orifices) may be allowed at the discretion of the [City Engineer] if the following conditions are met: 1) surface ponding depth drawdown time is less than 24 hours; and 2) safety issues and fencing requirements are considered (typically ponding greater than 18" will require a fence and/or flatter side slopes) and 3) potential for elevated clogging risk is considered.
<input type="checkbox"/> A minimum of 2 inches of freeboard is provided.	Freeboard provides room for head over overflow structures and minimizes risk of uncontrolled surface discharge.
<input type="checkbox"/> Side slopes are stabilized with vegetation and are = 3H:1V or shallower.	Gentler side slopes are safer, less prone to erosion, able to establish vegetation more quickly and easier to maintain.
<i>Vegetation</i>	
<input type="checkbox"/> Plantings are suitable for the climate and expected ponding depth. A plant list to aid in selection can be found in Appendix E.20.	Plants suited to the climate and ponding depth are more likely to survive.

Siting and Design

Intent/Rationale

- | | |
|---|---|
| <input type="checkbox"/> An irrigation system with a connection to water supply should be provided as needed. | Seasonal irrigation might be needed to keep plants healthy. |
|---|---|

Mulch (Optional or Mandatory – Dependent on jurisdiction)

- | | |
|---|--|
| <input type="checkbox"/> A minimum of 3 inches of well-aged, shredded hardwood mulch that has been stockpiled or stored for at least 12 months is provided. | Mulch will suppress weeds and maintain moisture for plant growth. Aging mulch kills pathogens and weed seeds and allows the beneficial microbes to multiply. |
|---|--|

Media Layer

- | | |
|--|--|
| <input type="checkbox"/> Media maintains a minimum filtration rate of 5 in/hr over lifetime of facility. An initial filtration rate of 8 to 12 in/hr is recommended to allow for clogging over time; the initial filtration rate should not exceed 12 inches per hour. | A filtration rate of at least 5 inches per hour allows soil to drain between events. The initial rate should be higher than long term target rate to account for clogging over time. However an excessively high initial rate can have a negative impact on treatment performance, therefore an upper limit is needed. |
|--|--|

Media is a minimum 18 inches deep, meeting either of these two media specifications:

- | | |
|--|--|
| <input type="checkbox"/> City of San Diego Low Impact Development Design Manual (page B-18) (July 2011, unless superseded by more recent edition) <u>or</u> County of San Diego Low Impact Development Handbook: Appendix G -Bioretention Soil Specification (June 2014, unless superseded by more recent edition).

Alternatively, for proprietary designs and custom media mixes not meeting the media specifications contained in the City or County LID Manual, the media meets the pollutant treatment performance criteria in Section F.1. | A deep media layer provides additional filtration and supports plants with deeper roots.

Standard specifications shall be followed.

For non-standard or proprietary designs, compliance with F.1 ensures that adequate treatment performance will be provided. |
|--|--|

- | | |
|---|--|
| <input type="checkbox"/> Media surface area is 3% of contributing area times adjusted runoff factor or greater. | Greater surface area to tributary area ratios: a) maximizes volume retention as required by the MS4 Permit and b) decrease loading rates per square foot and therefore increase longevity.

Adjusted runoff factor is to account for site design BMPs implemented upstream of the BMP (such as rain barrels, |
|---|--|

<i>Siting and Design</i>	<i>Intent/Rationale</i>
<input type="checkbox"/> Where receiving waters are impaired or have a TMDL for nutrients, the system is designed with nutrient sensitive media design (see fact sheet BF-2).	<p>impervious area dispersion, etc.). Refer to Appendix B.2 guidance.</p> <p>Use Worksheet B.5-1 Line 26 to estimate the minimum surface area required per this criteria.</p> <p>Potential for pollutant export is partly a function of media composition; media design must minimize potential for export of nutrients, particularly where receiving waters are impaired for nutrients.</p>
<i>Filter Course Layer</i>	
<input type="checkbox"/> A filter course is used to prevent migration of fines through layers of the facility. Filter fabric is not used.	<p>Migration of media can cause clogging of the aggregate storage layer void spaces or subgrade. Filter fabric is more likely to clog.</p>
<input type="checkbox"/> Filter course is washed and free of fines.	<p>Washing aggregate will help eliminate fines that could clog the facility and impede infiltration.</p>
<input type="checkbox"/> Filter course calculations assessing suitability for particle migration prevention have been completed.	<p>Gradation relationship between layers can evaluate factors (e.g., bridging, permeability, and uniformity) to determine if particle sizing is appropriate or if an intermediate layer is needed.</p>
<i>Aggregate Storage Layer</i>	
<input type="checkbox"/> Class 2 Permeable per Caltrans specification 68-1.025 is recommended for the storage layer. Washed, open-graded crushed rock may be used, however a 4-6 inch washed pea gravel filter course layer at the top of the crushed rock is required.	<p>Washing aggregate will help eliminate fines that could clog the aggregate storage layer void spaces or subgrade.</p>
<input type="checkbox"/> The depth of aggregate provided (12-inch typical) and storage layer configuration is adequate for providing conveyance for underdrain flows to the outlet structure.	<p>Proper storage layer configuration and underdrain placement will minimize facility drawdown time.</p>
<i>Inflow, Underdrain, and Outflow Structures</i>	
<input type="checkbox"/> Inflow, underdrains and outflow structures are accessible for inspection and maintenance.	<p>Maintenance will prevent clogging and ensure proper operation of the flow</p>

<i>Siting and Design</i>	<i>Intent/Rationale</i>
	control structures.
<input type="checkbox"/> Inflow velocities are limited to 3 ft/s or less or use energy dissipation methods. (e.g., riprap, level spreader) for concentrated inflows.	High inflow velocities can cause erosion, scour and/or channeling.
<input type="checkbox"/> Curb cut inlets are at least 12 inches wide, have a 4-6 inch reveal (drop) and an apron and energy dissipation as needed.	Inlets must not restrict flow and apron prevents blockage from vegetation as it grows in. Energy dissipation prevents erosion.
<input type="checkbox"/> Underdrain outlet elevation should be a minimum of 3 inches above the bottom elevation of the aggregate storage layer.	A minimal separation from subgrade or the liner lessens the risk of fines entering the underdrain and can improve hydraulic performance by allowing perforations to remain unblocked.
<input type="checkbox"/> Minimum underdrain diameter is 6 inches.	Smaller diameter underdrains are prone to clogging.
<input type="checkbox"/> Underdrains are made of slotted, PVC pipe conforming to ASTM D 3034 or equivalent or corrugated, HDPE pipe conforming to AASHTO 252M or equivalent.	Slotted underdrains provide greater intake capacity, clog resistant drainage, and reduced entrance velocity into the pipe, thereby reducing the chances of solids migration.
<input type="checkbox"/> An underdrain cleanout with a minimum 6-inch diameter and lockable cap is placed every 250 to 300 feet as required based on underdrain length.	Properly spaced cleanouts will facilitate underdrain maintenance.
<input type="checkbox"/> Overflow is safely conveyed to a downstream storm drain system or discharge point. Size overflow structure to pass 100-year peak flow for on-line infiltration basins and water quality peak flow for off-line basins.	Planning for overflow lessens the risk of property damage due to flooding.

Conceptual Design and Sizing Approach for Storm Water Pollutant Control Only

To design bioretention with underdrain for storm water pollutant control only (no flow control required), the following steps should be taken:

1. Verify that siting and design criteria have been met, including placement requirements, contributing tributary area, maximum side and finish grade slopes, and the recommended media surface area tributary ratio.
2. Calculate the DCV per Appendix B based on expected site design runoff for tributary areas.

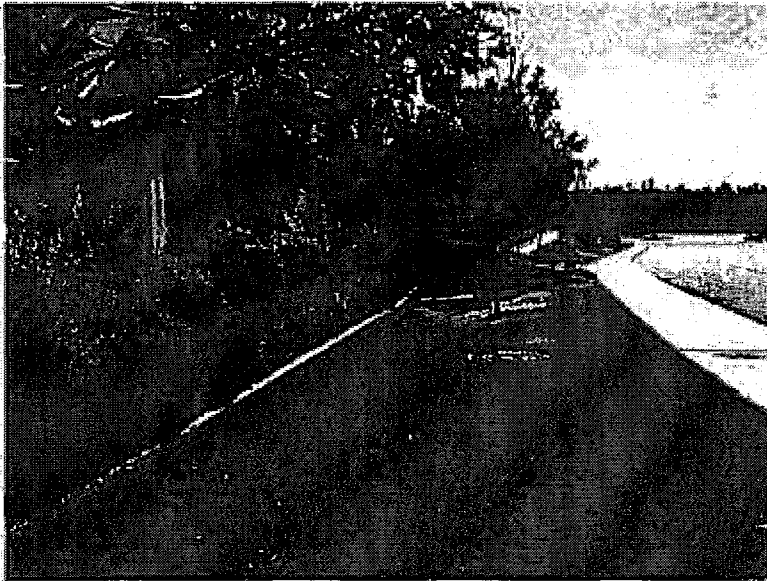
3. Use the sizing worksheet presented in Appendix B.5 to size biofiltration BMPs.

Conceptual Design and Sizing Approach when Storm Water Flow Control is Applicable

Control of flow rates and/or durations will typically require significant surface ponding and/or aggregate storage volumes, and therefore the following steps should be taken prior to determination of storm water pollutant control design. Pre-development and allowable post-project flow rates and durations should be determined as discussed in Chapter 6 of the manual.

1. Verify that siting and design criteria have been met, including placement requirements, contributing tributary area, maximum side and finish grade slopes, and the recommended media surface area tributary ratio.
2. Iteratively determine the facility footprint area, surface ponding and/or aggregate storage layer depth required to provide detention storage to reduce flow rates and durations to allowable limits. Flow rates and durations can be controlled from detention storage by altering outlet structure orifice size(s) and/or water control levels. Multi-level orifices can be used within an outlet structure to control the full range of flows.
3. If bioretention with underdrain cannot fully provide the flow rate and duration control required by this manual, an upstream or downstream structure with significant storage volume such as an underground vault can be used to provide remaining controls.
4. After bioretention with underdrain has been designed to meet flow control requirements, calculations must be completed to verify if storm water pollutant control requirements to treat the DCV have been met.

E-74 Vegetated Swale



MS4 Permit Category
Flow-thru Treatment Control

Manual Category
Flow-thru Treatment Control

Applicable Performance Standard
Pollutant Control

Primary Benefits
Treatment
Volume Reduction (Incidental)
Peak Flow Attenuation

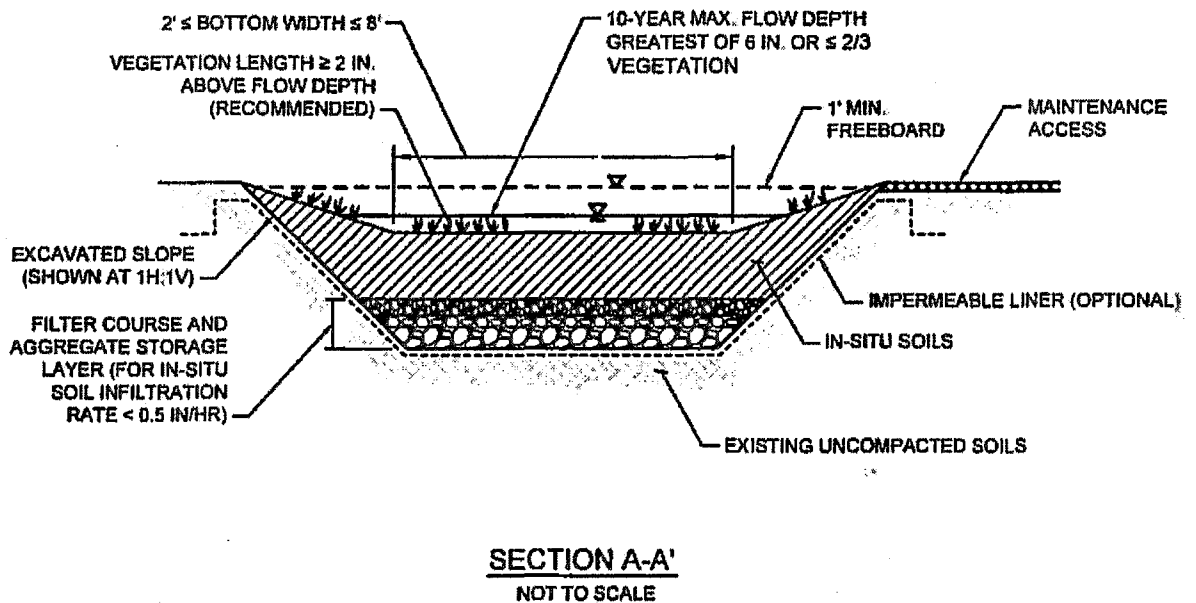
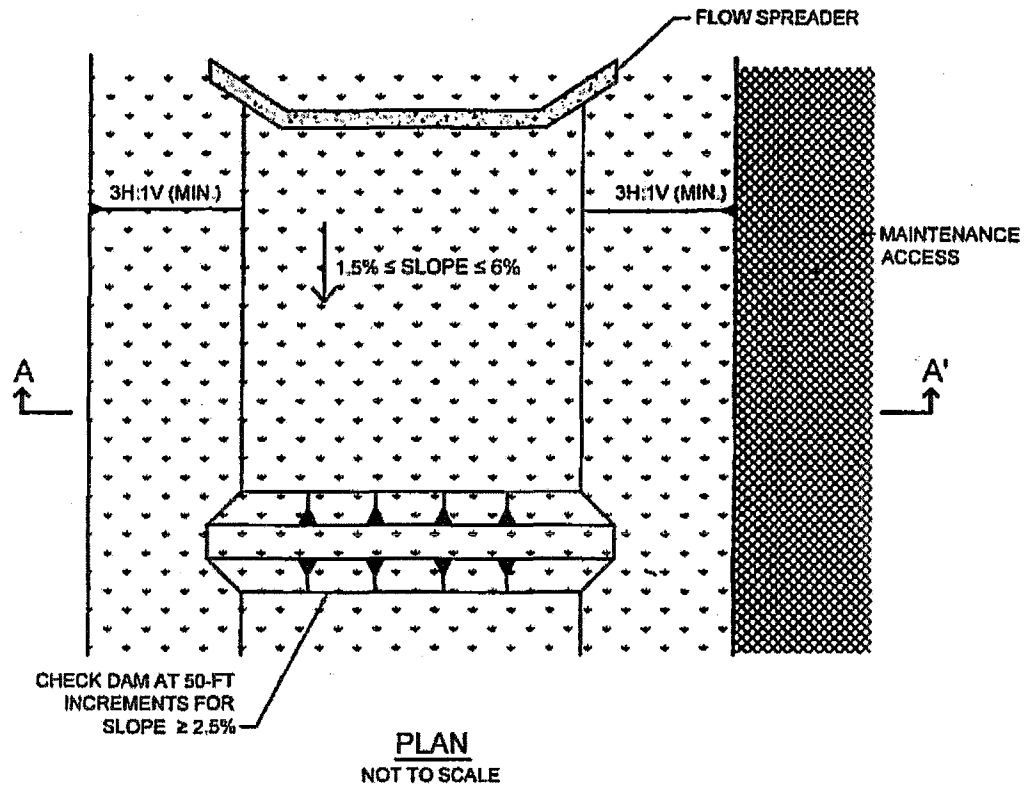
Location: Eastlake Business Center, Chula Vista, California; Photo Credit: Eric Mosolgo

Description

Vegetated swales are shallow, open channels that are designed to remove storm water pollutants by physically straining/filtering runoff through vegetation in the channel. Swales can be used in place of traditional curbs and gutters and are well-suited for use in linear transportation corridors to provide both conveyance and treatment via filtration. An effectively designed vegetated swale achieves uniform sheet flow through densely vegetated areas. When soil conditions allow, infiltration and volume reduction are enhanced by adding a gravel drainage layer underneath the swale. Vegetated swales with a subsurface media layer can provide enhanced infiltration, water retention, and pollutant-removal capabilities. Pollutant removal effectiveness can also be maximized by increasing the hydraulic residence time of water in swale using weirs or check dams.

Typical vegetated swale components include:

- Inflow distribution mechanisms (e.g., flow spreader)
- Surface flow
- Vegetated surface layer
- Check dams (if required)
- Optional aggregate storage layer with underdrain(s)



Typical plan and Section view of a Vegetated Swale BMP

Design Adaptations for Project Goals

Site design BMP to reduce runoff volumes and storm peaks. Swales without underdrains are an alternative to lined channels and pipes and can provide volume reduction through infiltration. Swales can also reduce the peak runoff discharge rate by increasing the time of concentration of the site and decreasing runoff volumes and velocities.

Flow-thru treatment BMP for storm water pollutant control. The system is lined or un-lined to provide incidental infiltration with an underdrain and designed to provide pollutant removal through settling and filtration in the channel vegetation (usually grasses). This configuration is considered to provide flow-thru treatment via horizontal surface flow through the swale. Sizing for flow-thru treatment control is based on the surface flow rate through the swale that meets water quality treatment performance objectives.

Design Criteria and Considerations

Vegetated swales must meet the following design criteria. Deviations from the below criteria may be approved at the discretion of the [City Engineer] if it is determined to be appropriate:

<i>Siting and Design</i>	<i>Intent/Rationale</i>
<input type="checkbox"/> Placement observes geotechnical recommendations regarding potential hazards (e.g., slope stability, landslides, and liquefaction zones) and setbacks (e.g., slopes, foundations, utilities).	Must not negatively impact existing site geotechnical concerns.
<input type="checkbox"/> An impermeable liner or other hydraulic restriction layer is included if site constraints indicate that infiltration or lateral flows should not be allowed.	Lining prevents storm water from impacting groundwater and/or sensitive environmental or geotechnical features. Incidental infiltration, when allowable, can aid in pollutant removal and groundwater recharge.
<input type="checkbox"/> Contributing tributary area ≤ 2 acres.	Higher ratios increase the potential for clogging but may be acceptable for relatively clean tributary areas.
<input type="checkbox"/> Longitudinal slope is $\geq 1.5\%$ and $\leq 6\%$.	Flatter swales facilitate increased water quality treatment while minimum slopes prevent ponding.
<input type="checkbox"/> For site design goal, in-situ soil infiltration rate ≥ 0.5 in/hr (if < 0.5 in/hr, an underdrain is required and design goal is for pollutant control only).	Well-drained soils provide volume reduction and treatment. An underdrain should only be provided when soil infiltration rates are low or per geotechnical or groundwater concerns.

<i>Siting and Design</i>	<i>Intent/Rationale</i>
Surface Flow	
<input type="checkbox"/> Maximum flow depth is ≤ 6 inches or $\leq \frac{2}{3}$ the vegetation length, whichever is greater. Ideally, flow depth will be ≥ 2 inches below shortest plant species.	Flow depth must fall within the height range of the vegetation for effective water quality treatment via filtering.
<input type="checkbox"/> A minimum of 1 foot of freeboard is provided.	Freeboard minimizes risk of uncontrolled surface discharge.
<input type="checkbox"/> Cross sectional shape is trapezoidal or parabolic with side slopes $\geq 3H:1V$.	Gentler side slopes are safer, less prone to erosion, able to establish vegetation more quickly and easier to maintain.
<input type="checkbox"/> Bottom width is ≥ 2 feet and ≤ 8 feet.	A minimum of 2 feet minimizes erosion. A maximum of 8 feet prevents channel braiding.
<input type="checkbox"/> Minimum hydraulic residence time ≥ 10 minutes.	Longer hydraulic residence time increases pollutant removal.
<input type="checkbox"/> Swale is designed to safely convey the 10-yr storm event unless a flow splitter is included to allow only the water quality event.	Planning for larger storm events lessens the risk of property damage due to flooding.
<input type="checkbox"/> Flow velocity is ≤ 1 ft/s for water quality event. Flow velocity for 10-yr storm event is ≤ 3 ft/s.	Lower flow velocities provide increased pollutant removal via filtration and minimize erosion.
Vegetated Surface Layer (amendment with media is Optional)	
<input type="checkbox"/> Soil is amended with 2 inches of media mixed into the top 6 inches of in-situ soils, as needed, to promote plant growth (optional). For enhanced pollutant control, 2 feet of media can be used in place of in-situ soils. Media meets either of these two media specifications: City of San Diego Low Impact Development Design Manual, July 2011 (page B-18); Or County of San Diego Low Impact Development Handbook, June 2014: Appendix G -Bioretention Soil Specification.	Amended soils aid in plant establishment and growth. Media replacement for in-situ soils can improve water quality treatment and site design volume reduction.

<i>Siting and Design</i>	<i>Intent/Rationale</i>
<input type="checkbox"/> Vegetation is appropriately selected low-growing, erosion-resistant plant species that effectively bind the soil, thrive under site-specific climatic conditions and require little or no irrigation.	Plants suited to the climate and expected flow conditions are more likely to survive.
<i>Check Dams</i>	
<input type="checkbox"/> Check dams are provided at 50-foot increments for slopes $\geq 2.5\%$.	Check dams prevent erosion and increase the hydraulic residence time by lowering flow velocities and providing ponding opportunities.
<i>Filter Course Layer (For Underdrain Design)</i>	
<input type="checkbox"/> A filter course is used to prevent migration of fines through layers of the facility. Filter fabric is not used.	Migration of media can cause clogging of the aggregate storage layer void spaces or subgrade. Filter fabric is more likely to clog.
<input type="checkbox"/> Filter course is washed and free of fines.	Washing aggregate will help eliminate fines that could clog the facility and impede infiltration.
<input type="checkbox"/> Filter course calculations assessing suitability for particle migration prevention have been completed.	Gradation relationship between layers can evaluate factors (e.g., bridging, permeability, and uniformity) to determine if particle sizing is appropriate or if an intermediate layer is needed.
<i>Aggregate Storage Layer (For Underdrain Design)</i>	
<input type="checkbox"/> The depth of aggregate provided (12-inch typical) and storage layer configuration is adequate for providing conveyance for underdrain flows to the outlet structure.	Proper storage layer configuration and underdrain placement will minimize facility drawdown time.
<input type="checkbox"/> Aggregate used for the aggregate storage layer is washed and free of fines.	Washing aggregate will help eliminate fines that could clog aggregate storage layer void spaces or underdrain.
<i>Inflow and Underdrain Structures</i>	
<input type="checkbox"/> Inflow and underdrains are accessible for inspection and maintenance.	Maintenance will prevent clogging and ensure proper operation of the flow control structures.
<input type="checkbox"/> Underdrain outlet elevation should be a minimum of 3 inches above the bottom	A minimal separation from subgrade or the liner lessens the risk of fines entering the underdrain and can improve hydraulic

<i>Siting and Design</i>	<i>Intent/Rationale</i>
elevation of the aggregate storage layer.	performance by allowing perforations to remain unblocked.
<input type="checkbox"/> Minimum underdrain diameter is 6 inches.	Smaller diameter underdrains are prone to clogging.
<input type="checkbox"/> Underdrains are made of slotted, PVC pipe conforming to ASTM D 3034 or equivalent or corrugated, HDPE pipe conforming to AASHTO 252M or equivalent.	Slotted underdrains provide greater intake capacity, clog resistant drainage, and reduced entrance velocity into the pipe, thereby reducing the chances of solids migration.
<input type="checkbox"/> An underdrain cleanout with a minimum 6-inch diameter and lockable cap is placed every 250 to 300 feet as required based on underdrain length.	Properly spaced cleanouts will facilitate underdrain maintenance.

Conceptual Design and Sizing Approach for Site Design

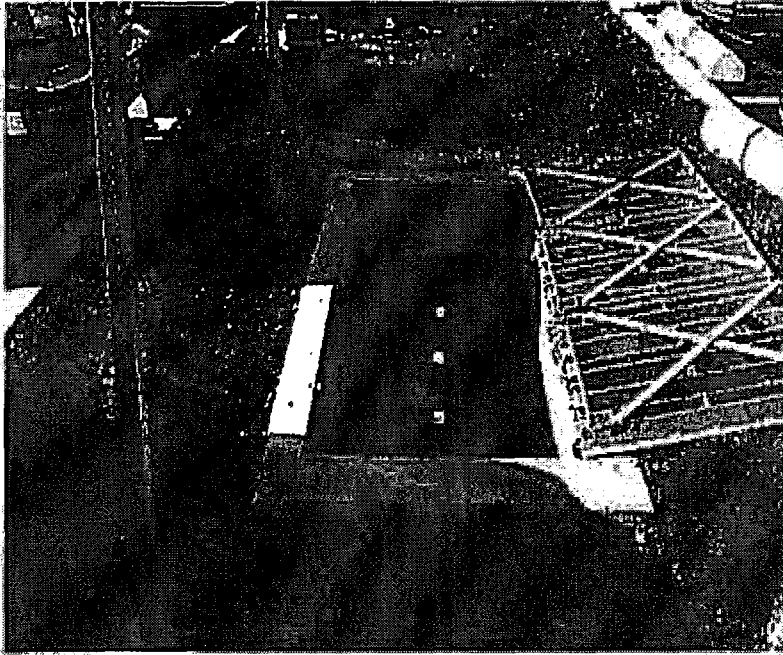
1. Determine the areas where vegetated swales can be used in the site design to replace traditional curb and gutter facilities and provide volume reduction through infiltration.

Conceptual Design and Sizing Approach for Storm Water Pollutant Control Only

To design vegetated swales for storm water pollutant control only, the following steps should be taken:

1. Verify that siting and design criteria have been met, including bottom width and longitudinal and side slope requirements.
2. Calculate the design flow rate per Appendix B based on expected site design runoff for tributary areas.
3. Use the sizing worksheet to determine flow-thru treatment sizing of the vegetated swale and if flow velocity, flow depth, and hydraulic residence time meet required criteria. Swale configuration should be adjusted as necessary to meet design requirements.

E-16 FT-3 Media Filters



MS4 Permit Category
Flow-thru Treatment Control

Manual Category
Flow-thru Treatment Control

Applicable Performance Standard
Pollutant Control
Flow Control

Primary Benefits
Treatment
Peak Flow Attenuation (Optional)

Photo Credit: Contech Stormwater Solutions

Description

Media filters are manufactured devices that consist of a series of modular filters packed with engineered media that can be contained in a catch basin, manhole, or vault that provide treatment through filtration and sedimentation. The manhole or vault may be divided into multiple chambers where the first chamber acts as a presettling basin for removal of coarse sediment while the next chamber acts as the filter bay and houses the filter cartridges. A variety of media types are available from various manufacturers that can target pollutants of concern via primarily filtration, sorption, ion exchange, and precipitation. Specific products must be selected to meet the flow-thru BMP selection requirements described in Appendix B.6. Treatment effectiveness is contingent upon proper maintenance of filter units.

Typical media filter components include:

- Vault for flow storage and media housing
- Inlet and outlet
- Media filters

Design Adaptations for Project Goals

Flow-thru treatment BMP for storm water pollutant control. Water quality treatment is provided through filtration. This configuration is considered to provide flow-thru treatment, not biofiltration treatment. Storage provided within the vault restricted by an outlet is considered detention storage and is included in calculations for the flow-thru treatment volume.

Integrated storm water flow control and pollutant control configuration. Media filters can also be designed for flow rate and duration control via additional detention storage. The vault storage can be designed to accommodate higher volumes than the storm water pollutant control volume and can utilize multi-stage outlets to mitigate both the duration and rate of flows within a prescribed range.

Design Criteria and Considerations

Media filters must meet the following design criteria. Deviations from the below criteria may be approved at the discretion of the [City Engineer] if it is determined to be appropriate:

<i>Siting and Design</i>	<i>Intent/Rationale</i>
<input type="checkbox"/> Placement observes geotechnical recommendations regarding potential hazards (e.g., slope stability, landslides, and liquefaction zones) and setbacks (e.g., slopes, foundations, utilities).	Must not negatively impact existing site geotechnical concerns.
<input type="checkbox"/> Recommended for tributary areas with limited available surface area or where surface BMPs would restrict uses.	Maintenance needs may be more labor intensive for media filters than surface BMPs. Lack of surface visibility creates additional risk that maintenance needs may not be completed in a timely manner.
<input type="checkbox"/> Vault storage drawdown time ≤ 96 hours.	Provides vector control.
<input type="checkbox"/> Vault storage drawdown time ≤ 36 hours if the vault is used for equalization of flows for pollutant treatment.	Provides required capacity to treat back to back storms. Exception to the 36 hour drawdown criteria is allowed if additional vault storage is provided using the curves in Appendix B.4.2.

Inflow and Outflow Structures

<input type="checkbox"/> Inflow and outflow structures are accessible by required equipment (e.g., vector truck) for inspection and maintenance.	Maintenance will prevent clogging and ensure proper operation of the flow control structures.
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Conceptual Design and Sizing Approach for Storm Water Pollutant Control Only

To design a media filter for storm water pollutant control only (no flow control required), the following steps should be taken

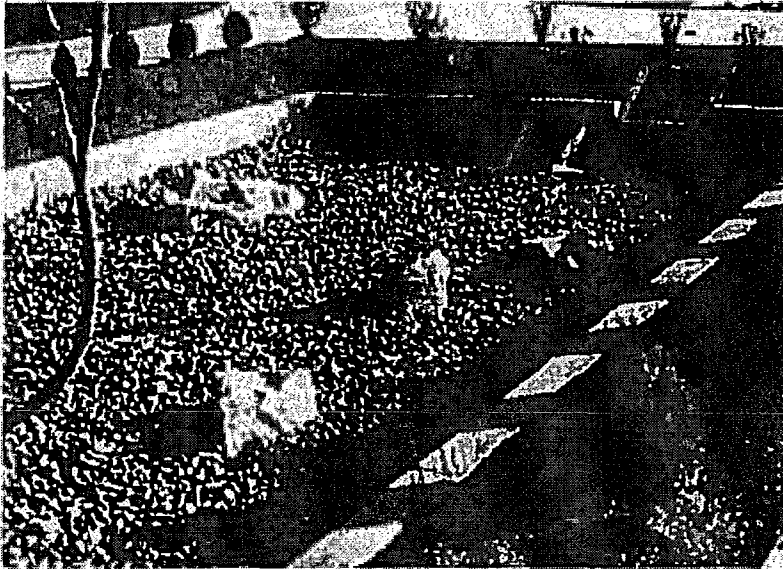
1. Verify that the selected BMP complies with BMP selection requirements in Appendix B.6.
2. Verify that placement and tributary area requirements have been met.
3. Calculate the required DCV and/or flow rate per Appendix B.6.3 based on expected site design runoff for tributary areas.
4. Media filter can be designed either for DCV or flow rate. To estimate the drawdown time, divide the vault storage by the treatment rate of media filters.

Conceptual Design and Sizing Approach when Storm Water Flow Control Is Applicable

Control of flow rates and/or durations will typically require significant vault storage volume, and therefore the following steps should be taken prior to determination of storm water pollutant control design. Pre-development and allowable post-project flow rates and durations should be determined as discussed in Chapter 6 of the manual.

1. Verify that placement and tributary area requirements have been met.
2. Iteratively determine the vault storage volume required to provide detention storage to reduce flow rates and durations to allowable limits. Flow rates and durations can be controlled from detention storage by altering outlet structure orifice size(s) and/or water control levels. Multi-level orifices can be used within an outlet structure to control the full range of flows to MS4.
3. If a media filter cannot fully provide the flow rate and duration control required by this manual, an upstream or downstream structure with appropriate storage volume such as an underground vault can be used to provide remaining controls.
4. After the media filter has been designed to meet flow control requirements, calculations must be completed to verify if storm water pollutant control requirements to treat the DCV have been met.
5. Verify that the vault drawdown time is 96 hours or less. To estimate the drawdown time:
 - a. Divide the vault volume by the filter surface area.
 - b. Divide the result (a) by the design filter rate.

1.17 Sand Filters



MS4 Permit Category
Flow-thru Treatment Control

Manual Category
Flow-thru Treatment Control

Applicable Performance Standard
Pollutant Control
Flow Control

Primary Benefits
Treatment
Volume Reduction (Incidental)
Peak Flow Attenuation (Optional)

Photo Credit: City of San Diego LID Manual

Description

Sand filters operate by filtering storm water through a constructed sand bed with an underdrain system. Runoff enters the filter and spreads over the surface. Sand filter beds can be enclosed within concrete structures or within earthen containment. As flows increase, water backs up on the surface of the filter where it is held until it can percolate through the sand. The treatment pathway is downward (vertical) through the media to an underdrain system that is connected to the downstream storm drain system. As storm water passes through the sand, pollutants are trapped on the surface of the filter, in the small pore spaces between sand grains or are adsorbed to the sand surface. The high filtration rates of sand filters, which allow a large runoff volume to pass through the media in a short amount of time, can provide efficient treatment for storm water runoff.

Typical sand filter components include:

- Forebay for pretreatment/energy dissipation
- Surface ponding for captured flows
- Sand filter bed
- Aggregate storage layer with underdrain(s)
- Overflow structure

TABLE 2

RUNOFF COEFFICIENTS (RATIONAL METHOD)

DEVELOPED AREAS (URBAN)

<u>Land Use</u>	<u>Coefficient, C</u> <u>Soil Type (1)</u>
Residential:	<u>D</u>
Single Family	.55
Multi-Units	.70
Mobile Homes	.65
Rural (lots greater than 1/2 acre)	.45
Commercial (2)	
80% Impervious	.85
Industrial (2)	
90% Impervious	.95

NOTES:

- (1) Type D soil to be used for all areas.
- (2) Where actual conditions deviate significantly from the tabulated imperviousness values of 80% or 90%, the values given for coefficient C, may be revised by multiplying 80% or 90% by the ratio of actual imperviousness to the tabulated imperviousness. However, in no case shall the final coefficient be less than 0.50. For example: Consider commercial property on D soil.

Actual imperviousness	=	50%
Tabulated imperviousness	=	80%
Revised C	=	$\frac{50}{80} \times 0.85 = 0.53$

Run-off Coefficients Calculations

Existing Conditions

Basin A1- Total Area= 1.08AC

Landscape Area = 0.24 AC

Impervious Area = 0.84 AC

$$\frac{[0.35*(0.24)] + [(0.95)*(.84)]}{1.08} = 0.82$$

Basin A2- Total Area= 0.28AC

Landscape Area = 0.18 AC

Impervious Area = 0.10AC

$$\frac{[0.35*(0.18)] + [(0.95)*(.10)]}{0.28} = 0.56$$

Basin A3- Total Area= 3.19 AC

Landscape Area = 2.77 AC

Impervious Area = 0.42 AC

$$\frac{[0.35*(2.77)] + [(0.95)*(.42)]}{3.19} = 0.43, \text{ use } C=0.50 \text{ (per Exhibit L, C cannot be } <0.50)$$

Basin A4- Total Area= 0.96 AC

Landscape Area = 0.83 AC

Impervious Area = 0.13 AC

$$\frac{[0.35*(0.83)] + [(0.95)*(.13)]}{0.96} = 0.43, \text{ use } C=0.50 \text{ (per Exhibit L, C cannot be } <0.50)$$

Basin B

Landscape Area = 0.50 AC

Impervious Area = 0.86 AC

$$\frac{[0.35*(0.50)] + [(0.95)*(.86)]}{1.36} = 0.73$$

Proposed Conditions

Basin C1- Total Area= 1.08 AC

Landscape Area = 0.24 AC

Impervious Area = 0.84 AC

$$\frac{[0.35*(0.24)] + [(0.95)*(.84)]}{1.08} = 0.82$$

Basin C2- Total Area= 0.28 AC

Landscape Area = 0.18 AC

Impervious Area = 0.10AC

$$\frac{[0.35*(0.18)] + [(0.95)*(.10)]}{0.28} = 0.56$$

Basin C3- Total Area= 3.02 AC

Landscape Area = 2.60 AC

Impervious Area = 0.42 AC

$$\frac{[0.35*(2.60)] + [(0.95)*(.42)]}{3.02} = 0.43, \text{ use } C=0.50 \text{ (per Exhibit L, } C \text{ cannot be } <0.50)$$

Basin C4- Total Area= 0.71 AC (Area does not include 18,455sf from Skate Park, see separate calcs in Appendix G)

Landscape Area = 0.56 AC

Impervious Area = 0.15 AC

$$\frac{[0.35*(0.56)] + [(0.95)*(.15)]}{0.71} = 0.48, \text{ use } C=0.50 \text{ (per Exhibit L, } C \text{ cannot be } <0.50)$$

Basin D

Landscape Area = 0.60 AC

Impervious Area = 0.76 AC

$$\frac{[0.35*(0.60)] + [(0.95)*(.76)]}{1.36} = 0.69$$

Sub-Basin C Calculations

Basin D2A=0.58 acres

Landscape Area= 0.43 AC

Impervious=0.15 AC

$$\frac{[0.35*(0.43)] + [(0.95)*(0.15)]}{0.58} = 0.51$$

0.58

Basin D2B=0.12 acres

Landscape Area= 0.03 AC

Impervious=0.09 AC

$$\frac{[0.35*(0.03)] + [(0.95)*(0.09)]}{0.12} = 0.80$$

0.12

ELEV.	FACTOR
0-1500	1.00
1500-3000	1.25
3000-4000	1.42
4000-5000	1.60
5000-6000	1.70
DESERT	1.25

To obtain correct intensity,
multiply intensity on chart
by factor for design
elevation.

83

RAINFALL
INTENSITY - DURATION - FREQUENCY
CURVES
for
COUNTY OF SAN DIEGO

APPENDIX J.

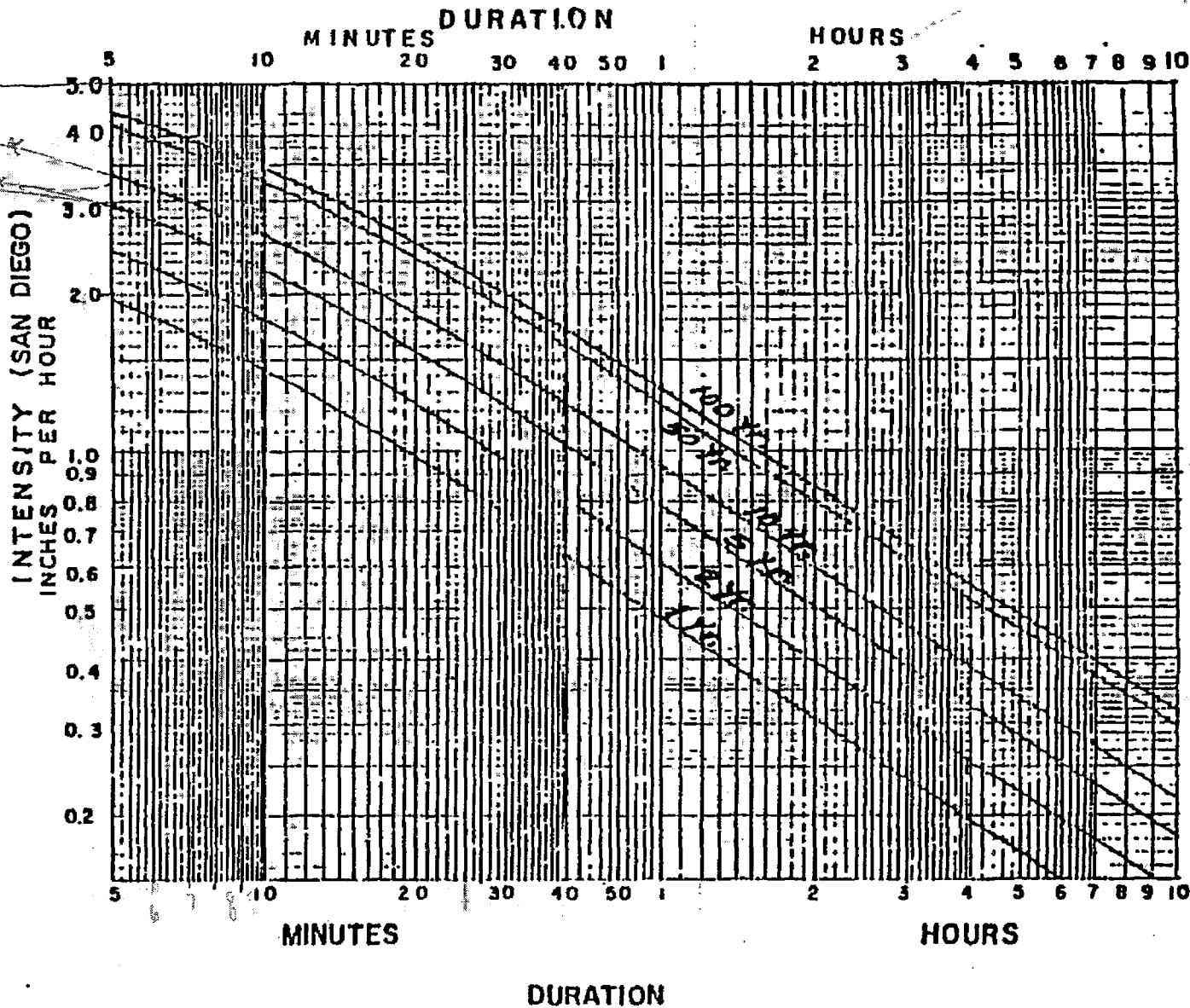
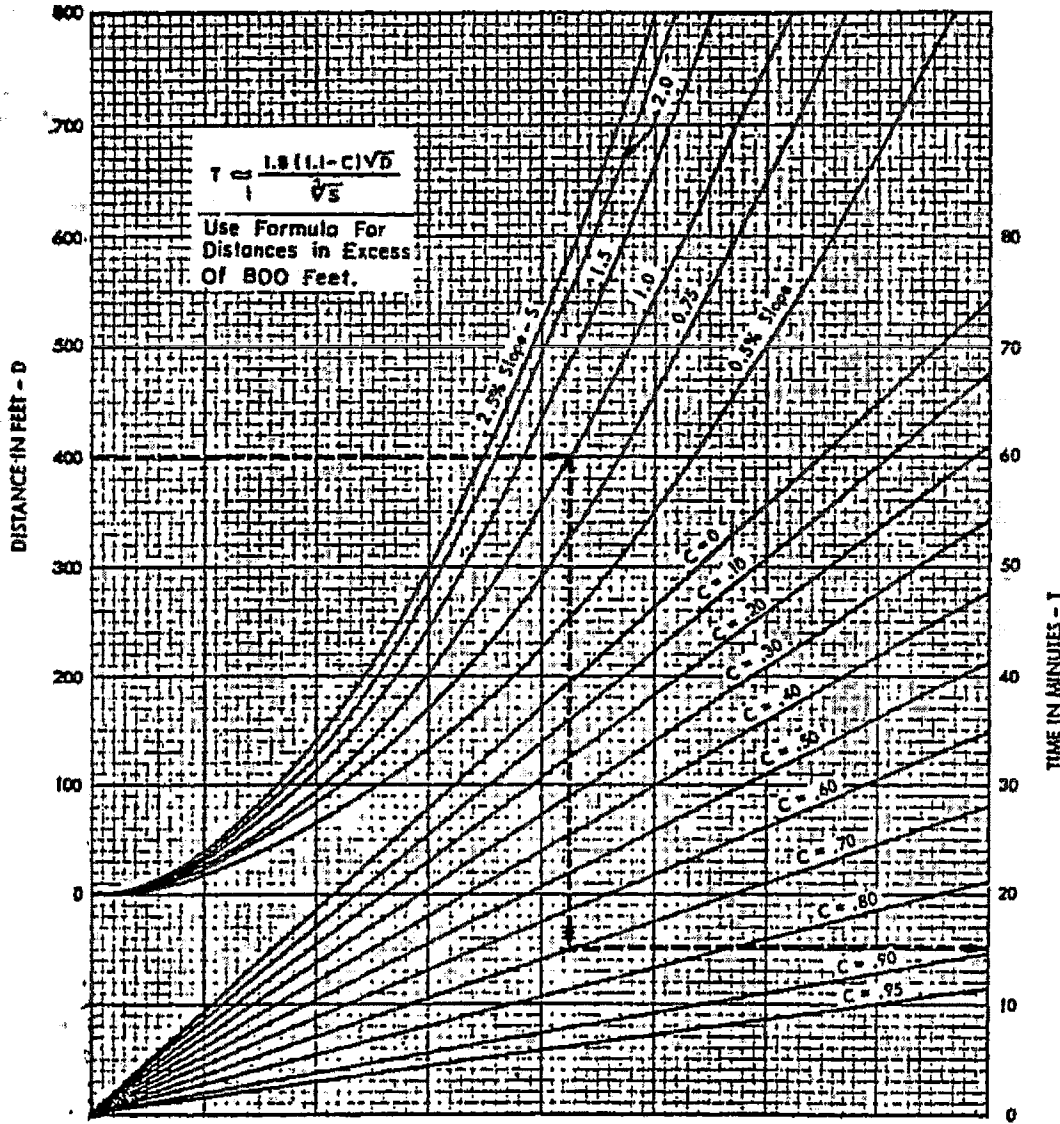


EXHIBIT
M

EXHIBIT

URBAN AREAS OVERLAND TIME OF FLOW CURVES



Surface Flow Time Curves

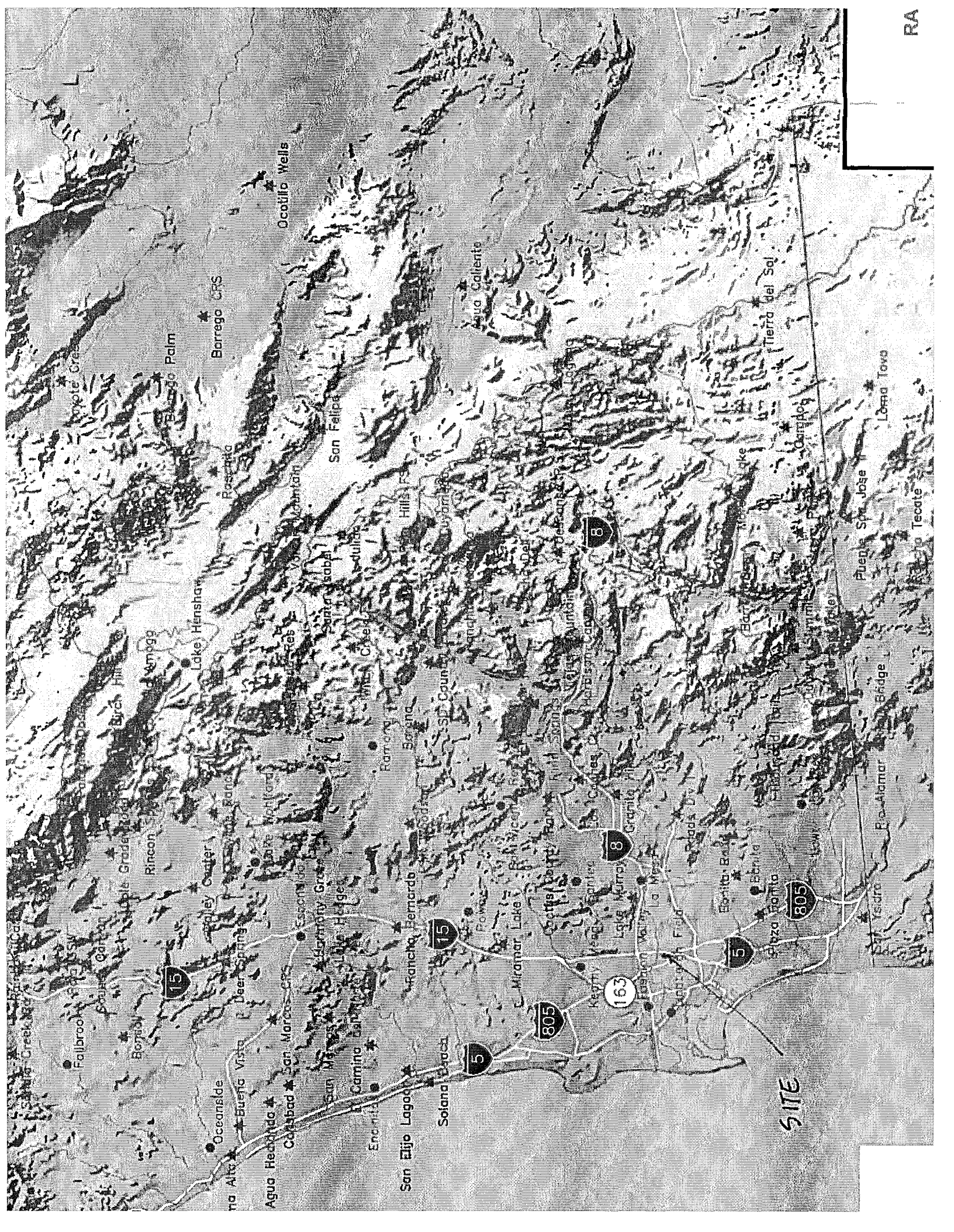
EXAMPLE:

GIVEN: LENGTH OF FLOW = 400 FT.

SLOPE = 1.0%

COEFFICIENT OF RUNOFF C = .70

READ: OVERLAND FLOWTIME = 15 MINUTES



San El Eljo Lagunas

San El Eljo

San El Eljo

San El Eljo

San El Eljo

San El Eljo

San El Eljo

San El Eljo

San El Eljo

San El Eljo

Oceanside

Escondido

San Marcos

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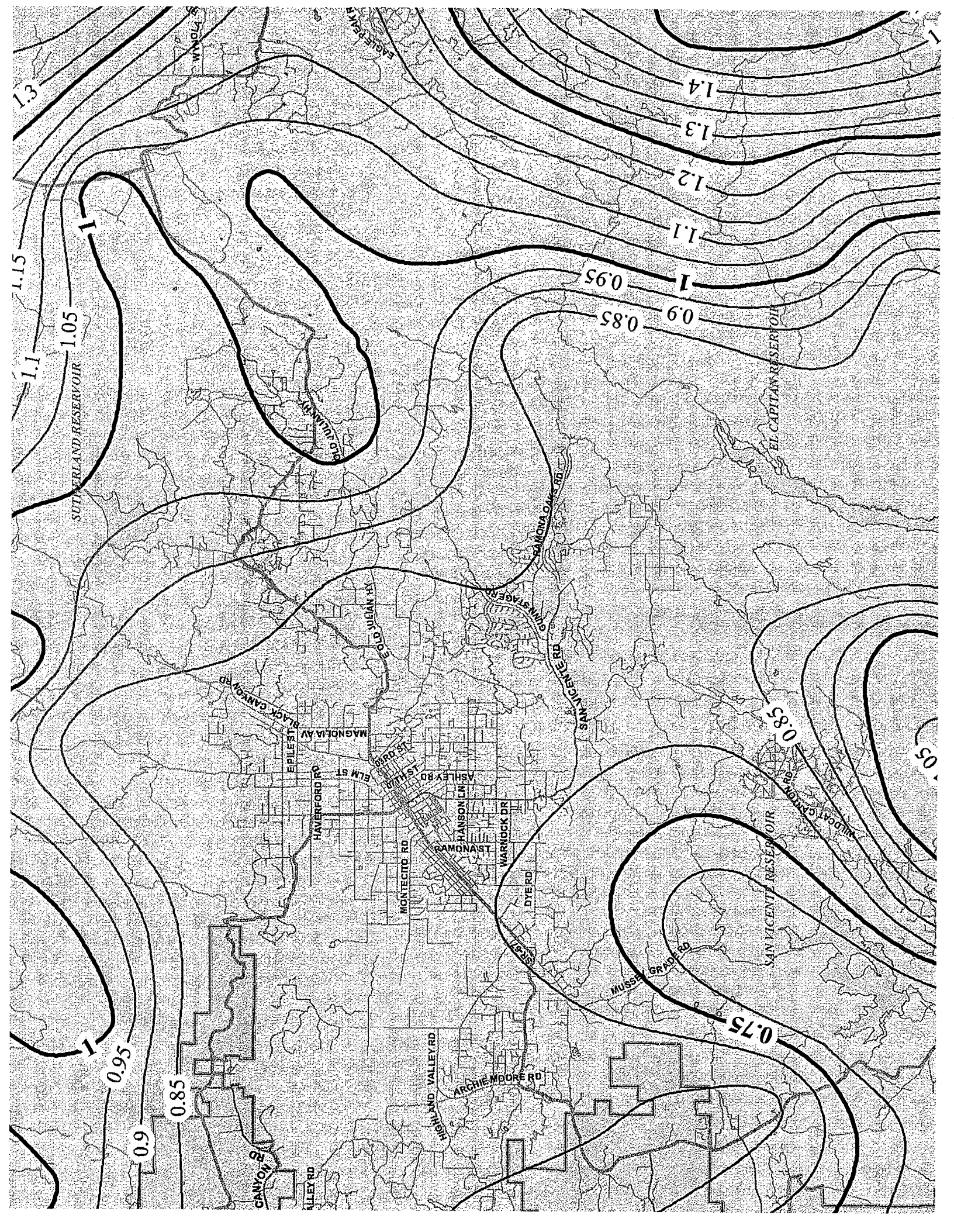
SITE

Summary by Map Unit — San Diego County Area, California (CA638)

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
QHE	Olivenhain cobbly loam, 9 to 30 percent slopes	D	5.7	71.4%
Ur	Urban land		2.3	28.6%

Totals for Area of Interest





Appendix G: Guidance for Continuous Simulation and Hydromodification Management Sizing Factors

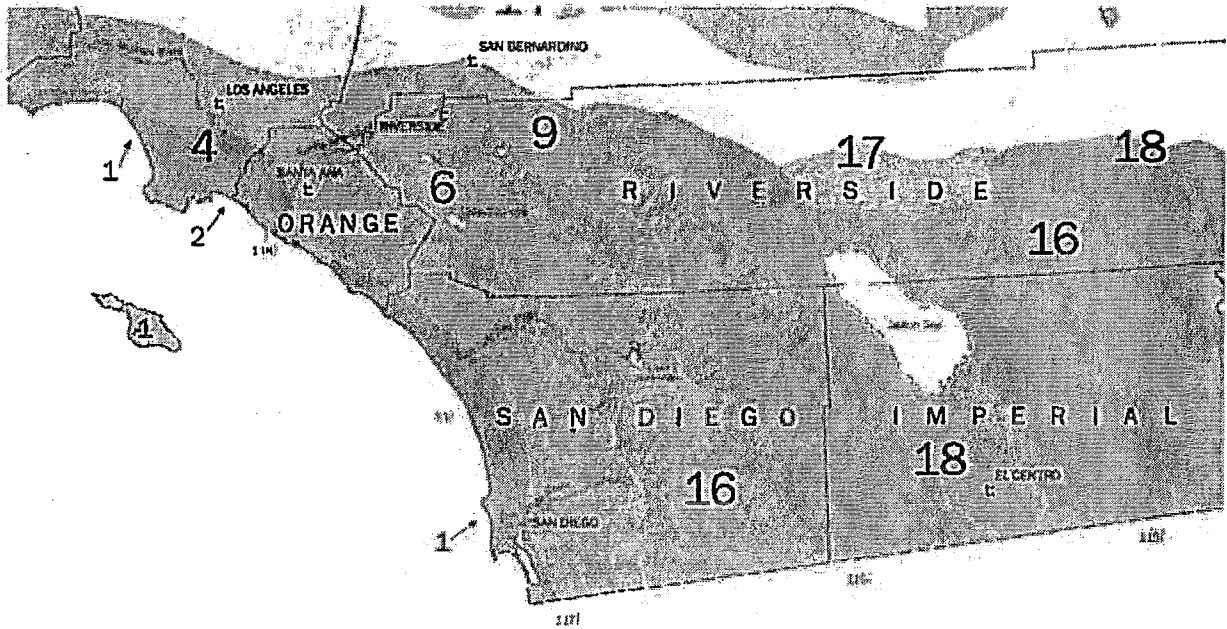


Figure G.1-2: California Irrigation Management Information System "Reference Evapotranspiration Zones"

Appendix G: Guidance for Continuous Simulation and Hydromodification Management Sizing Factors

**Table G.1-1: Monthly Average Reference Evapotranspiration by ETo Zone
(inches/month and inches/day) for use in SWMM Models for Hydromodification Management Studies in San Diego County
CIMIS Zones 1, 4, 6, 9, and 16 (See CIMIS ETo Zone Map)**

	January	February	March	April	May	June	July	August	September	October	November	December
Zone	in/month	in/month	in/month	in/month	in/month	in/month	in/month	in/month	in/month	in/month	in/month	in/month
1	0.93	1.4	2.48	3.3	4.03	4.5	4.65	4.03	3.3	2.48	1.2	0.62
4	1.86	2.24	3.41	4.5	5.27	5.7	5.89	5.58	4.5	3.41	2.4	1.86
6	1.86	2.24	3.41	4.8	5.58	6.3	6.51	6.2	4.8	3.72	2.4	1.86
9	2.17	2.8	4.03	5.1	5.89	6.6	7.44	6.82	5.7	4.03	2.7	1.86
16	1.55	2.52	4.03	5.7	7.75	8.7	9.3	8.37	6.3	4.34	2.4	1.55
	January	February	March	April	May	June	July	August	September	October	November	December
Days	31	28	31	30	31	30	31	31	30	31	30	31
Zone	in/day	in/day	in/day	in/day	in/day	in/day	in/day	in/day	in/day	in/day	in/day	in/day
1	0.030	0.050	0.080	0.110	0.130	0.150	0.150	0.130	0.110	0.080	0.040	0.020
4	0.060	0.080	0.110	0.150	0.170	0.190	0.190	0.180	0.150	0.110	0.080	0.060
6	0.060	0.080	0.110	0.160	0.180	0.210	0.210	0.200	0.160	0.120	0.080	0.060
9	0.070	0.100	0.130	0.170	0.190	0.220	0.240	0.220	0.190	0.130	0.090	0.060
16	0.050	0.090	0.130	0.190	0.250	0.290	0.300	0.270	0.210	0.140	0.080	0.050

Appendix G: Guidance for Continuous Simulation and Hydromodification Management Sizing Factors

Table G.1-4: Subcatchment Parameters for SWMM Studies for Hydromodification Management in San Diego

SWMM Parameter Name	Unit	Range	Use in San Diego
Name X-Coordinate Y-Coordinate Description Tag Rain Gage Outlet	N/A	N/A – project-specific	Project-specific
Area	acres (ac)	Project-specific	Project-specific
Width	feet (ft)	Project-specific	Project-specific
% Slope	percent (%)	Project-specific	Project-specific
% Imperv	percent (%)	Project-specific	Project-specific
N-imperv	--	0.011 – 0.024 presented in Table A.6 of SWMM Manual	default use 0.012 for smooth concrete, otherwise provide documentation of other surface consistent with Table A.6 of SWMM Manual
N-Perv	--	0.05 – 0.80 presented in Table A.6 of SWMM Manual	default use 0.15 for short prairie grass, otherwise provide documentation of other surface consistent with Table A.6 of SWMM Manual
Dstore-Imperv	inches	0.05 – 0.10 inches presented in Table A.5 of SWMM Manual	0.05
Dstore-Perv	inches	0.10 – 0.30 inches presented in Table A.5 of SWMM Manual	0.10
%ZeroImperv	percent (%)	0% – 100%	25%
Subarea routing	--	OUTLET IMPERVIOUS PERVIOUS	Project-specific, typically OUTLET
Percent Routed	%	0% – 100%	Project-specific, typically 100%
Infiltration	Method	HORTON GREEN_AMPT CURVE_NUMBER	GREEN_AMPT

Appendix G: Guidance for Continuous Simulation and Hydromodification Management Sizing Factors

SWMM Parameter Name	Unit	Range	Use in San Diego
Suction Head (Green-Ampt)	Inches	1.93 – 12.60 presented in Table A.2 of SWMM Manual	Hydrologic Soil Group A: 1.5 Hydrologic Soil Group B: 3.0 Hydrologic Soil Group C: 6.0 Hydrologic Soil Group D: 9.0
Conductivity (Green-Ampt)	Inches per hour	0.01 – 4.74 presented in Table A.2 of SWMM Manual by soil texture class 0.00 – ≥ 0.45 presented in Table A.3 of SWMM Manual by hydrologic soil group	Hydrologic Soil Group A: 0.3 Hydrologic Soil Group B: 0.2 Hydrologic Soil Group C: 0.1 Hydrologic Soil Group D: 0.025 Note: reduce conductivity by 25% in the post-project condition when native soils will be compacted. For fill soils in post-project condition, see Section G.1.4.3.
Initial Deficit (Green-Ampt)		The difference between soil porosity and initial moisture content. Based on the values provided in Table A.2 of SWMM Manual, the range for completely dry soil would be 0.097 to 0.375	Hydrologic Soil Group A: 0.30 Hydrologic Soil Group B: 0.31 Hydrologic Soil Group C: 0.32 Hydrologic Soil Group D: 0.33 Note: in long-term continuous simulation, this value is not important as the soil will reach equilibrium after a few storm events regardless of the initial moisture content specified.
Groundwater	yes/no	yes/no	NO
LID Controls			Project Specific
Snow Pack Land Uses Initial Buildup Curb Length			Not applicable to hydromodification management studies

G.1.4.3 Pervious Area Rainfall Loss Parameters in Post-Project Condition (HSPF, SDHM, and SWMM)

The following guidance applies to HSPF, SDHM, and SWMM. When modeling pervious areas in the post-project condition, fill soils shall be modeled as hydrologic soil group Type D soils, or the

G.1.5.3.2 Characteristics of Gravel

For the purpose of hydromodification management studies, it may be assumed that water moves freely through gravel, not limited by hydraulic properties of the gravel. For the purpose of calculating available volume, use porosity of 0.4, or void ratio of 0.67. Porosity is equal to void ratio divided by (1 + void ratio).

G.1.5.3.3 Additional Guidance for SDHM Users

The module titled "bioretention/rain garden element" may be used to represent bioretention or biofiltration BMPs. SDHM users using the available "bioretention/rain garden element" shall customize the soil media characteristics to use the parameters from Table G.1-6 above, and select "gravel" for gravel sublayers. All other input variables are project-specific. "Native infiltration" refers to infiltration from the bottom of the structural BMP into the native soil. This variable is project-specific, see Section G.1.5.1.

G.1.5.3.4 Additional Guidance for SWMM Users

The "bio-retention cell" LID control may be used to represent bioretention or biofiltration BMPs. Table G.1-7 provides parameters required for the standard "bio-retention cell" available in SWMM. The parameters are entered in the LID Control Editor.

Table G.1-7: Parameters for SWMM "Bio-Retention Cell" Module for Hydromodification Management Studies in San Diego

SWMM Parameter Name	Unit	Use in San Diego
<i>Surface</i>		
Berm Height also known as Storage Depth	inches	Project-specific
Vegetative Volume Fraction also known as Vegetative Cover Fraction	---	0
Surface Roughness	---	0 (this parameter is not applicable to bio-retention cell)
Surface Slope	---	0 (this parameter is not applicable to bio-retention cell)
<i>Soil</i>		
Thickness	inches	project-specific
Porosity	---	0.40
Field Capacity	----	0.2

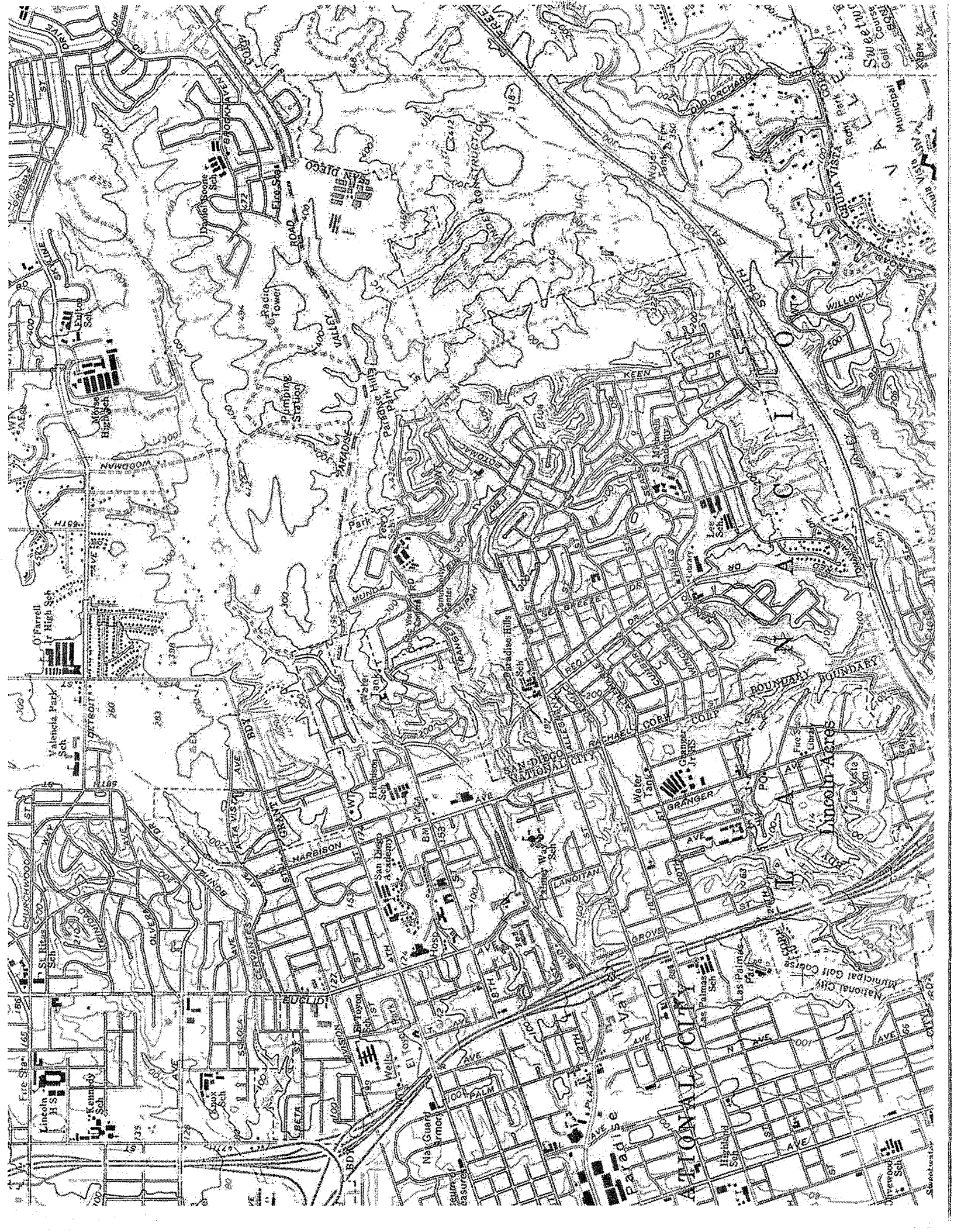
Appendix G: Guidance for Continuous Simulation and Hydromodification Management Sizing Factors

SWMM Parameter Name	Unit	Use in San Diego
Wilting Point	-----	0.1
Conductivity	Inches/hour	5
Conductivity Slope	-----	5
Suction Head	inches	1.5
Storage		
Thickness also known as Height	inches	Project-specific
Void Ratio	-----	0.67
Seepage Rate also known as Conductivity	Inches/hour	Conductivity from the storage layer refers to infiltration from the bottom of the structural BMP into the native soil. This variable is project-specific, see Section G.5.1. Use 0 if the bio-retention cell includes an impermeable liner
Clogging Factor	-----	0
Underdrain		
Flow Coefficient Also known as Drain Coefficient	-----	Project-specific
Flow Exponent Also known as Drain Exponent	-----	Project-specific, typically 0.5
Offset Height Also known as Drain Offset Height	Inches	Project-specific

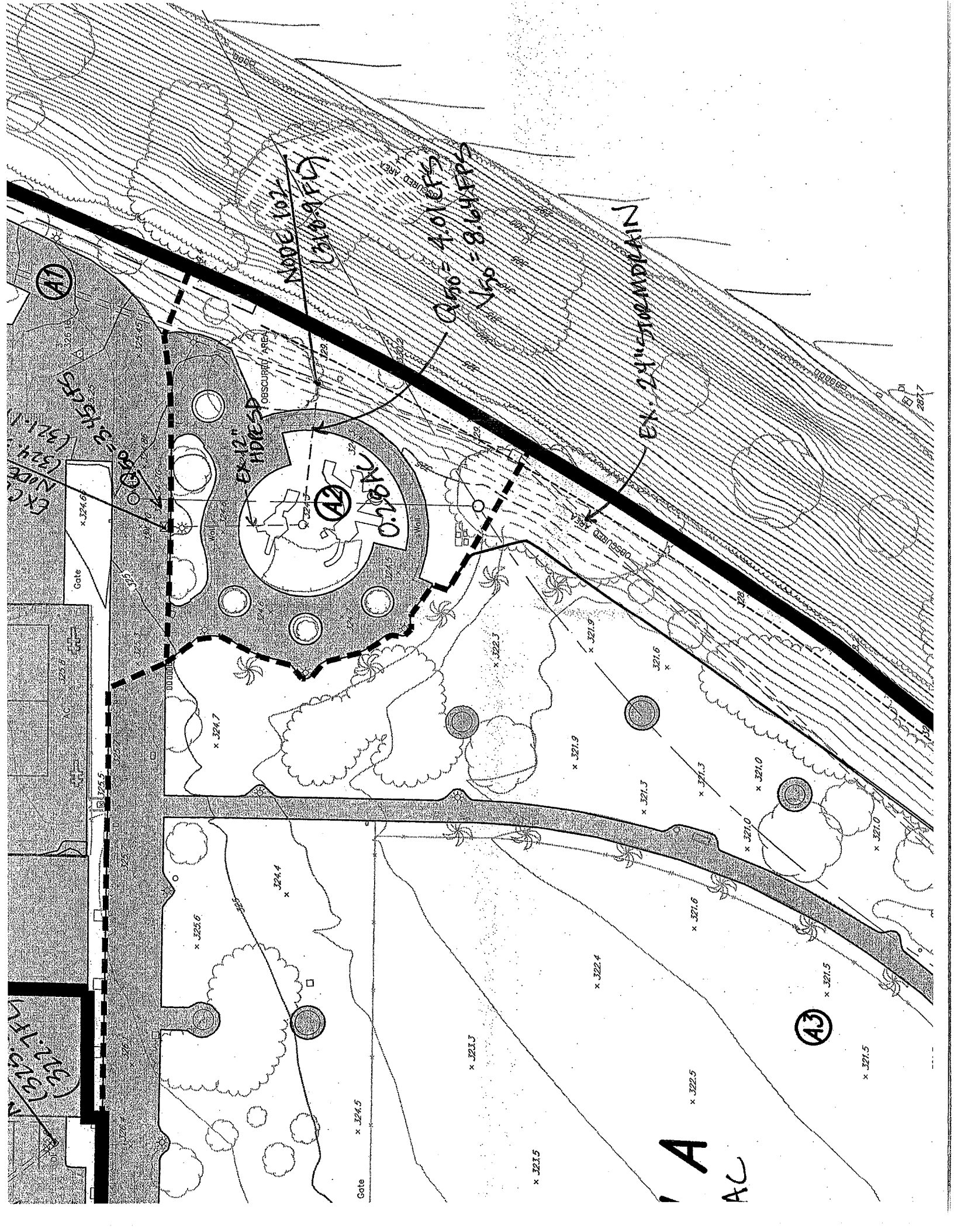
G.1.6 FLOW FREQUENCY AND DURATION

The continuous simulation model will generate an hourly flow record as its output. This hourly flow record must then be processed to determine pre-development and post-project flow rates and durations. Compliance with hydromodification management requirements of this manual is achieved when results for flow frequency and duration meet the performance standards. The performance standards are as follows (also presented in Chapter 6 of this manual):

1. For flow rates ranging from 10 percent, 30 percent or 50 percent of the pre-development 2-year runoff event ($0.1Q_2$, $0.3Q_2$, or $0.5Q_2$) to the pre-development 10-year runoff event (Q_{10}), the post-project discharge rates and durations shall not deviate above the pre-development rates and durations by more than 10 percent over and more than 10 percent of







MADE 10/22
12:00 PM

Q100 = 4.01 FPS
V100 = 9.64 FPS

EX. 24 IN. DIME MIDRAIN

OBSERVED AREA

EX-12" HDI/ESP

(A2)
0.187 AU

(A1)

(A3)

A

AC

EX. 3.15 FTFS
NOR. (324.1)

EX. 3.12 FTFS
NOR. (324.1)

x 324.6

Gate

x 324.7

x 324.5

x 324.4

x 325.6

x 324.4

x 323.3

x 324.5

Gate

x 324.7

x 324.4

x 324.5

x 323.3

x 321.5

x 322.4

x 321.9

x 321.3

x 322.5

x 321.6

x 321.3

x 321.0

x 321.0

x 321.5

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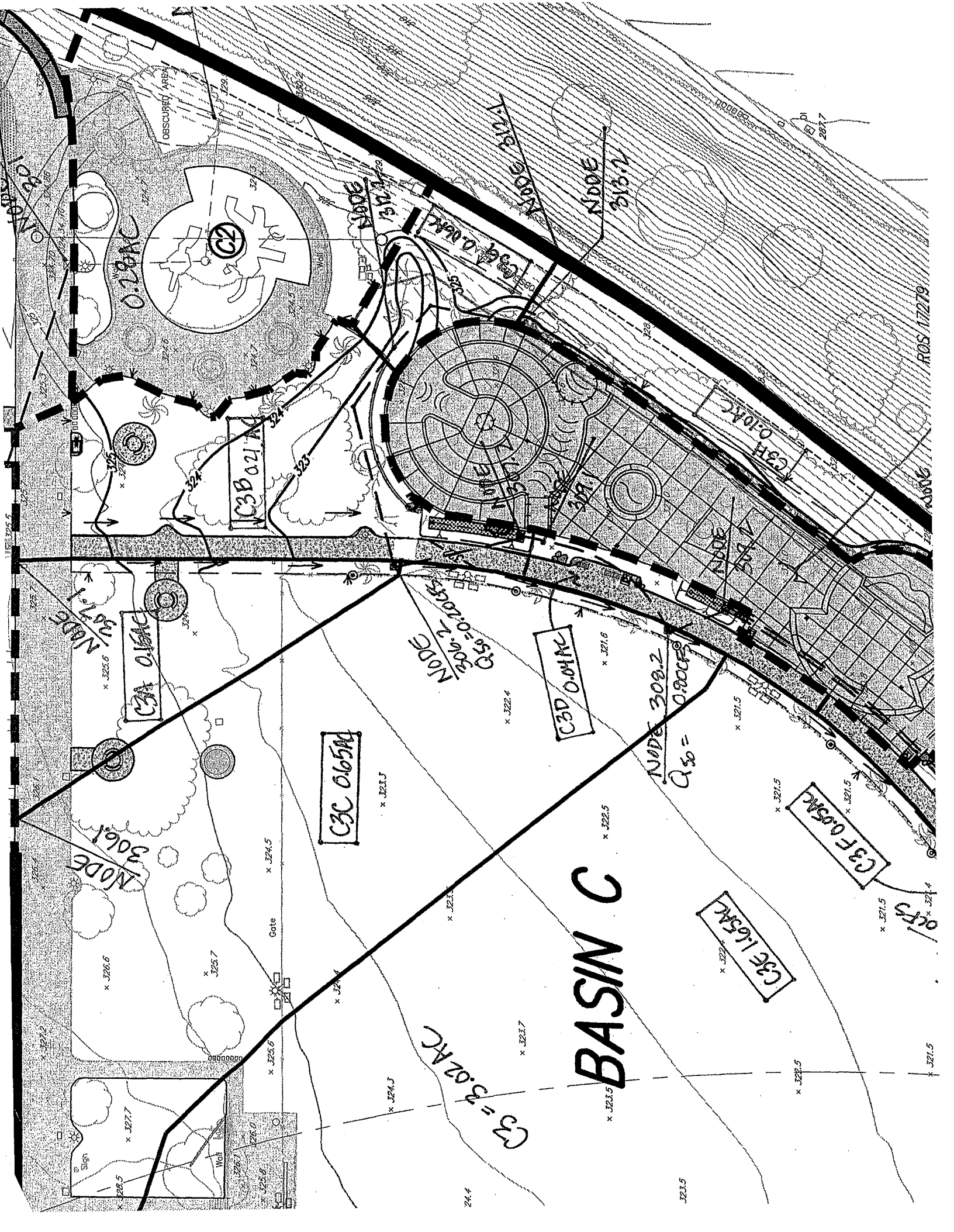
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BASIN C

C3A 0.16AC

C3B 0.21AC

C3C 0.165AC

C3D 0.04AC

C3E 1.65AC

C3F 0.05AC

C3H 0.10AC

OBSCURED AREA

Gate

Sign

Well

ROS 172.79

County of San Diego Hydrology Manual



Rainfall Isopleths

50 Year Rainfall Event - 6 Hours

..... Isopleth (inches)



DPW GIS
SanGIS
We Have San Diego Covered

THESE DATA WERE OBTAINED FROM THE SAN DIEGO COUNTY GIS DEPARTMENT. SAN GIS IS A REGISTERED TRADEMARK OF SAN GIS, INC. ALL RIGHTS RESERVED. THIS PRODUCT IS PROVIDED AS-IS WITHOUT WARRANTY OF ANY KIND. THE USER ASSUMES ALL LIABILITY FOR ANY DAMAGE TO DATA OR EQUIPMENT. THE USER ASSUMES ALL LIABILITY FOR ANY DAMAGE TO DATA OR EQUIPMENT. THE USER ASSUMES ALL LIABILITY FOR ANY DAMAGE TO DATA OR EQUIPMENT.

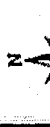


EXHIBIT X



Appendix B: Storm Water Pollutant Control Hydrologic Calculations and Sizing Methods

DCV is defined as the volume of storm water runoff resulting from the 85th percentile, 24-hr storm event. The following hydrologic method shall be used to calculate the DCV:

$$DCV = C \times d \times A \times 43,560 \text{ sf/ac} \times 1/12 \text{ in/ft}$$

$$DCV = 3,630 \times C \times d \times A$$

Where:

DCV = Design Capture Volume in cubic feet

C = Runoff factor (unitless); refer to section B.1.1

d = 85th percentile, 24-hr storm event rainfall depth (inches), refer to section B.1.3

A = Tributary area (acres) which includes the total area draining to the BMP, including any offsite or onsite areas that comingles with project runoff and drains to the BMP. Refer to Chapter 3, Section 3.3.3 for additional guidance. Street redevelopment projects consult section 1.4.3.

B.1.1 Runoff Factor

Estimate the area weighted runoff factor for the tributary area to the BMP using runoff factor (from Table B.1-1) and area of each surface type in the tributary area and the following equation:

$$C = \frac{\sum C_x A_x}{\sum A_x}$$

Where:

C_x = Runoff factor for area X

A_x = Tributary area X (acres)

These runoff factors apply to areas receiving direct rainfall only. For conditions in which runoff is routed onto a surface from an adjacent surface, see Section B.2 for determining composite runoff factors for these areas.

Table B.1-1: Runoff factors for surfaces draining to BMPs – Pollutant Control BMPs

Surface	Runoff Factor
Roofs ¹	0.90
Concrete or Asphalt ¹	0.90
Unit Pavers (grouted) ¹	0.90
Decomposed Granite	0.30
Cobbles or Crushed Aggregate	0.30
Amended, Mulched Soils or Landscape	0.10
Compacted Soil (e.g., unpaved parking)	0.30

1. Surface is considered impervious and could benefit from use of Site Design BMPs and adjustment of the runoff factor per Section B.2.1.

Appendix B: Storm Water Pollutant Control Hydrologic Calculations and Sizing Methods

Surface	Runoff Factor
Natural (A Soil)	0.10
Natural (B Soil)	0.14
Natural (C Soil)	0.23
Natural (D Soil)	0.30

B.1.2 Offline BMPs

Diversion flow rates for offline BMPs shall be sized to convey the maximum flow rate of runoff produced from a rainfall intensity of 0.2 inch of rainfall per hour, for each hour of every storm event. The following hydrologic method shall be used to calculate the diversion flow rate for off-line BMPs:

$$Q = C \times i \times A$$

Where:

Q = Diversion flow rate in cubic feet per second

C = Runoff factor, area weighted estimate using Table B.1

i = Rainfall intensity of 0.2 in/hr

A = Tributary area (acres) which includes the total area draining to the BMP, including any offsite or onsite areas that comingle with project runoff and drain to the BMP. Refer to Chapter 3, Section 3.3.3 for additional guidance. Street redevelopment projects also consult Section 1.4.3.

B.1.3 85th Percentile, 24-Hour Storm Event

The 85th percentile, 24-hour isopleth map is provided as Figure B.1-1. The rainfall depth to estimate the DCV shall be determined using Figure B.1-1. The methodology used to develop this map is presented below:

B.1.3.1 Gage data and calculation of 85th percentile

The method of calculating the 85th percentile is to produce a list of values, order them from smallest to largest, and then pick the value that is 85 percent of the way through the list. Only values that are capable of producing runoff are of interest for this purpose. Lacking a legislative definition of rainfall values capable of producing runoff, Flood Control staff in San Diego County have observed that the point at which significant runoff begins is rather subjective, and is affected by land use type and soil moisture. In highly-urbanized areas, the soil has a high impermeability and runoff can begin with as little as 0.02" of rainfall. In rural areas, soil impermeability is significantly lower and even 0.30" of rain on dry soil will frequently not produce significant runoff. For this reason, San Diego County has chosen to use the more objective method of including all non-zero 24-hour



THE CITY OF SAN DIEGO

City of San Diego
Development Services
1222 First Ave., MS-501
San Diego, CA 92101
(619) 236-5500

Permanent BMP Construction

Self Certification Form

FORM
DS-563
FEBRUARY 2013

Date Prepared: _____ Project No.: _____

Project Applicant: _____ Phone: _____

Project Address: _____

Project Engineer: _____ Phone: _____

The purpose of this form is to verify that the site improvements for the project, identified above, have been constructed in conformance with the approved Standard Urban Storm Water Mitigation Plan (SUSMP) documents and drawings.

This form must be completed by the engineer and submitted prior to final inspection of the construction permit. Completion and submittal of this form is required for all new development and redevelopment projects in order to comply with the City's Storm Water ordinances and NDPES Permit Order No. R9-2007-0001. Final inspection for occupancy and/or release of grading or public improvement bonds may be delayed if this form is not submitted and approved by the City of San Diego.

CERTIFICATION:

As the professional in responsible charge for the design of the above project, I certify that I have inspected all constructed Low Impact Development (LID) site design, source control and treatment control BMP's required per the approved SUSMP and Construction Permit No. _____; and that said BMP's have been constructed in compliance with the approved plans and all applicable specifications, permits, ordinances and Order No. R9-2007-0001 of the San Diego Regional Water Quality Control Board.

I understand that this BMP certification statement does not constitute an operation and maintenance verification.

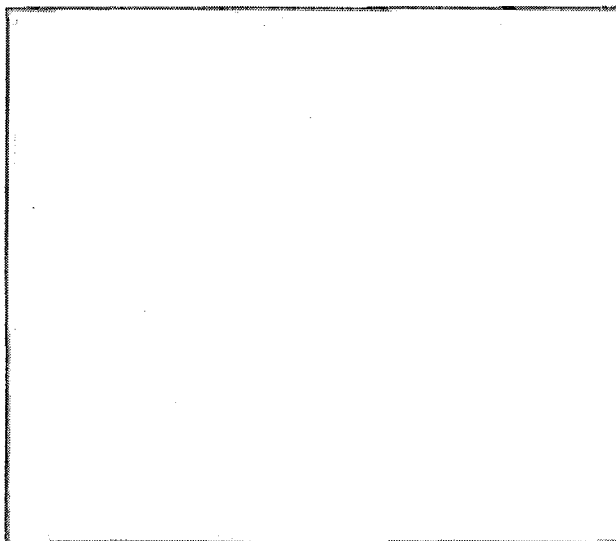
Signature: _____

Date of Signature: _____

Printed Name: _____

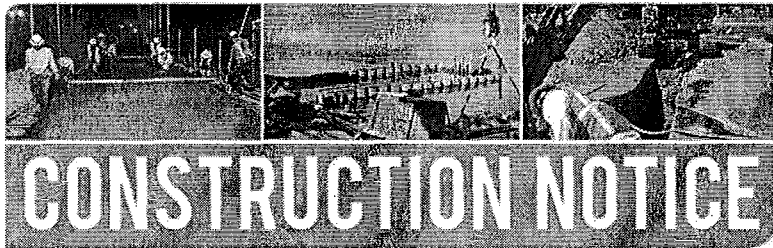
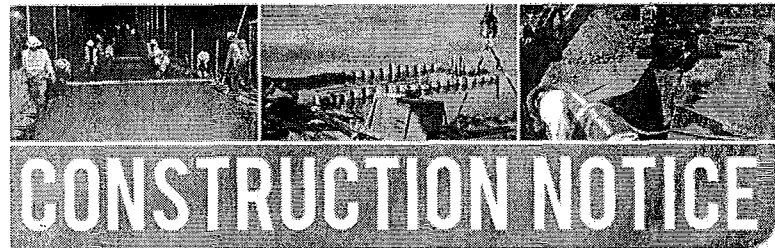
Title: _____

Phone No. _____



Engineer's Stamp

APPENDIX H
SAMPLE OF PUBLIC NOTICES



PROJECT NAME

PROJECT NAME

The work will consist of:

- *Edit this information:* The construction work will include pot holing in the northbound curb lane of Torrey Pines Road between Coast Walk and Princess Street.

How your neighborhood may be impacted:

- *Edit this information:* Traffic delays due to lane closure.
- Two-way traffic will be maintained at all times.

Anticipated Construction Schedule

- *Edit this information:* The project upgrades for the entire neighborhood have been ongoing and now are scheduled to start on your street.
- The entire neighborhood project started in ____ and is anticipated to be complete in ____.

Hours and Days of Operation

- *Edit this information:* Monday to Friday (7:30 a.m. to 4 p.m.)

The work will consist of:

- *Edit this information:* The construction work will include pot holing in the northbound curb lane of Torrey Pines Road between Coast Walk and Princess Street.

How your neighborhood may be impacted:

- *Edit this information:* Traffic delays due to lane closure.
- Two-way traffic will be maintained at all times.

Anticipated Construction Schedule

- *Edit this information:* The project upgrades for the entire neighborhood have been ongoing and now are scheduled to start on your street.
- The entire neighborhood project started in ____ and is anticipated to be complete in ____.

Hours and Days of Operation

- *Edit this information:* Monday to Friday (7:30 a.m. to 4 p.m.)

For questions related to this work

Call: (619) 533-4207

Email: engineering@sandiego.gov

Visit: sandiego.gov/CIP

For questions related to this work

Call: (619) 533-4207

Email: engineering@sandiego.gov

Visit: sandiego.gov/CIP

APPENDIX I
PHASE II PRE-QUALIFICATION SUBMITTAL REQUIREMENTS
AND MATERIALS

Phase II Pre-Qualification Submittal Requirements and Materials

CONTRACTOR EXPERIENCE:

To be considered a qualified and responsible Bidder, the CONTRACTOR shall provide documentation establishing that they and/or their subcontractor has satisfied the experience requirements listed below:

1. The CONTRACTOR or their SUBCONTRACTOR shall have completed at least one (1) custom poured in place concrete skate park facility with a minimum size of 15,000 square feet within the last five (5) years. The Contractor and/or their subcontractor shall have performed all concrete & metal work for the project listed with the scope inclusion of one (1) bowls of 9'-0" minimum depth, including concrete and metal coping & tile. The shotcrete nozzlemen performing the shotcrete work shall have been Certified in accordance with ACI 506.3R. Referenced Skate Parks shall be open and in good operating condition for at least one (1) year. Contractor may provide more than one project to demonstrate required experience.
2. Reference projects shall demonstrate experience in shaping of earthwork to specified radius'; cast in place concave and convex shaped concrete elements containing compound radius curves; application of vertical and horizontal shotcrete work including horizontal and vertical radius transitions that include compound radius curves and blends, formed concrete, grinding rails, and associated concrete reinforcement; installation of steel coping edges, smooth flowing seamless transition areas, and smooth troweled concrete finish work; layout, fabrication, and construction of the steel coping; and installation of concrete flatwork between bowled areas.

**PHASE II PRE-QUALIFICATION REFERENCE FORM
Park De La Cruz Neighborhood Park Improvements – Phase I**

Firm Name _____
Address _____
City, State, Zip _____
Contact Name/Telephone _____
California License # _____

SIMILAR CONSTRUCTION PROJECTS COMPLETED

Names and references shall be current and verifiable.

References will be contacted and interviewed.

Copy this sheet as necessary and provide the following information regarding:

Similar projects completed within the last five (5) years. One similar project is required to qualify.

Project Name: _____

Location: _____

Owner: _____

Contact: _____ **Phone:** _____ **Email:** _____

Architect or Engineer: _____

Contact: _____ **Phone:** _____ **Email:** _____

Construction Manager: _____ **Phone:** _____

Description of Project, Scope of Work Performed: _____

Total Value of Construction (including change orders): _____

Scheduled Completion Date: _____ **Actual Completion Date:** _____

Extension Time Granted (Number of Days): _____

ATTACHMENT F
INTENTIONALLY LEFT BLANK

ATTACHMENT G

CONTRACT AGREEMENT

CONTRACT AGREEMENT

CONSTRUCTION CONTRACT

This contract is made and entered into between THE CITY OF SAN DIEGO, a municipal corporation, herein called "City", and California Skateparks, herein called "Contractor" for construction of **Park de La Cruz Neighborhood Park Improvements – Phase I**; Bid No. **K-16-1457-DBB-3-A**; in the amount of Three Million Four Hundred Nine Thousand Nine Hundred Forty Dollars and 00/100 (\$3,409,940.00), which is comprised of the Base Bid.

IN CONSIDERATION of the payments to be made hereunder and the mutual undertakings of the parties hereto, City and Contractor agree as follows:

1. The following are incorporated into this contract as though fully set forth herein:
 - (a) The attached Faithful Performance and Payment Bonds.
 - (b) The attached Proposal included in the Bid documents by the Contractor.
 - (c) Reference Standards listed in the Instruction to Bidders and the Supplementary Special Provisions (SSP).
 - (e) That certain documents entitled **Park de La Cruz Neighborhood Park Improvements – Phase I**, on file in the office of the Public Works Department as Document No. **S-15003**, as well as all matters referenced therein.
2. The Contractor shall perform and be bound by all the terms and conditions of this contract and in strict conformity therewith shall perform and complete in a good and workmanlike manner **Park de La Cruz Neighborhood Park Improvements – Phase I**, Bid Number **K-16-1457-DBB-3-A**, San Diego, California.
3. For such performances, the City shall pay to Contractor the amounts set forth at the times and in the manner and with such additions or deductions as are provided for in this contract, and the Contractor shall accept such payment in full satisfaction of all claims incident to such performances.
4. No claim or suit whatsoever shall be made or brought by Contractor against any officer, agent, or employee of the City for or on account of anything done or omitted to be done in connection with this contract, nor shall any such officer, agent, or employee be liable hereunder.
5. This contract is effective as of the date that the Mayor or designee signs the agreement.

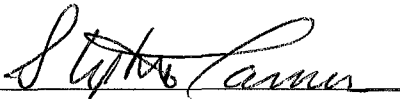
CONTRACT AGREEMENT (continued)

IN WITNESS WHEREOF, this Agreement is signed by the City of San Diego, acting by and through its Mayor or designee, pursuant to Municipal Code §22.3102 authorizing such execution.

THE CITY OF SAN DIEGO

APPROVED AS TO FORM

Jan I. Goldsmith, City Attorney

By 

By 

Print Name: Stephen Samara
Principal Contract Specialist
Public Works Department

Print Name: Mark W. Weber
Deputy City Attorney

Date: 8-1-16

Date: 8-1-16

CONTRACTOR

By 

Print Name: Joseph M. Ciaglia, Jr.

Title: President

Date: 07/18/2016

City of San Diego License No.: _____

State Contractor's License No.: 962150

1000016308

DEPARTMENT OF INDUSTRIAL RELATIONS (DIR) REGISTRATION NUMBER: _____

CERTIFICATIONS AND FORMS

The Bidder, by submitting its electronic bid, agrees to and certifies under penalty of perjury under the laws of the State of California, that the certifications, forms and affidavits submitted as part of this bid are true and correct.

Bidder's General Information

To the City of San Diego:

Pursuant to "Notice Inviting Bids", specifications, and requirements on file with the City Clerk, and subject to all provisions of the Charter and Ordinances of the City of San Diego and applicable laws and regulations of the United States and the State of California, the undersigned hereby proposes to furnish to the City of San Diego, complete at the prices stated herein, the items or services hereinafter mentioned. The undersigned further warrants that this bid is not made in the interest of, or on behalf of, any undisclosed person, partnership, company, association, organization, or corporation; that the bid is genuine and not collusive or sham; that the bidder has not directly or indirectly induced or solicited any other bidder to put in a false or sham bid, and has not directly or indirectly colluded, conspired, connived, or agreed with any bidder or anyone else to put in a sham bid, or that anyone shall refrain from bidding; that the bidder has not in any manner, directly or indirectly, sought by agreement, communication, or conference with anyone to fix the bid price of the bidder or any other bidder, or to fix any overhead, profit, or cost element of the bid price, or of that of any other bidder, or to secure any advantage against the public body awarding the contract of anyone interested in the proposed contract; that all statements contained in the bid are true; and, further, that the bidder has not, directly or indirectly, submitted his or her bid price or any breakdown thereof, or the contents thereof, or divulged information or data relative thereto, or paid, and will not pay, any fee to any corporation, partnership, company, association, organization, bid depository, or to any member or agent thereof to effectuate a collusive or sham bid.

The undersigned bidder(s) further warrants that bidder(s) has thoroughly examined and understands the entire Contract Documents (plans and specifications) and the Bidding Documents therefore, and that by submitting said Bidding Documents as its bid proposal, bidder(s) acknowledges and is bound by the entire Contract Documents, including any addenda issued thereto, as such Contract Documents incorporated by reference in the Bidding Documents.

**NON-COLLUSION AFFIDAVIT TO BE EXECUTED BY BIDDER AND SUBMITTED
WITH BID UNDER 23 UNITED STATES CODE 112 AND PUBLIC CONTRACT CODE
7106**

State of California
County of San Diego

The bidder, being first duly sworn, deposes and says that he or she is authorized by the party making the foregoing bid that the bid is not made in the interest of, or on behalf of, any undisclosed person, partnership, company, association, organization, or corporation; that the bid is genuine and not collusive or sham; that the bidder has not directly or indirectly induced or solicited any other bidder to put in a false or sham bid, and has not directly or indirectly colluded, conspired, connived, or agreed with any bidder or anyone else to put in a sham bid, or that anyone shall refrain from bidding; that the bidder has not in any manner, directly or indirectly, sought by agreement, communication, or conference with anyone to fix the bid price of the bidder or any other bidder, or to fix any overhead, profit, or cost element of the bid price, or of that of any other bidder, or to secure any advantage against the public body awarding the contract of anyone interested in the proposed contract; that all statements contained in the bid are true; and further, that the bidder has not, directly or indirectly, submitted his or her bid price or any breakdown thereof, or the contents thereof, or divulged information or data relative thereto, or paid, and will not pay, any fee to any corporation, partnership, company association, organization, bid depository, or to any member or agent thereof to effectuate a collusive or sham bid.

CONTRACTOR CERTIFICATION

DRUG-FREE WORKPLACE

I hereby certify that I am familiar with the requirements of San Diego City Council Policy No. 100-17 regarding Drug-Free Workplace as outlined in the WHITEBOOK, Section 7-13.3, "Drug-Free Workplace", of the project specifications, and that;

This company has in place a drug-free workplace program that complies with said policy. I further certify that each subcontract agreement for this project contains language which indicates the subcontractor's agreement to abide by the provisions of subdivisions a) through c) of the policy as outlined.

CONTRACTOR CERTIFICATION

AMERICAN WITH DISABILITIES ACT (ADA) COMPLIANCE CERTIFICATION

I hereby certify that I am familiar with the requirements of San Diego City Council Policy No. 100-4 regarding the American With Disabilities Act (ADA) outlined in the WHITEBOOK, Section 7-13.2, "American With Disabilities Act", of the project specifications, and that;

This company has in place workplace program that complies with said policy. I further certify that each subcontract agreement for this project contains language which indicates the subcontractor's agreement to abide by the provisions of the policy as outlined.

CONTRACTOR CERTIFICATION

CONTRACTOR STANDARDS – PLEDGE OF COMPLIANCE

I declare under penalty of perjury that I am authorized to make this certification on behalf of the company submitting this bid/proposal, that as Contractor, I am familiar with the requirements of City of San Diego Municipal Code § 22.3004 regarding Contractor Standards as outlined in the WHITEBOOK, Section 7-13.4, ("Contractor Standards"), of the project specifications, and that Contractor has complied with those requirements.

I further certify that each of the Contractor's subcontractors whose subcontracts are greater than \$50,000 in value has completed a Pledge of Compliance attesting under penalty of perjury of having complied with City of San Diego Municipal Code § 22.3004.

AFFIDAVIT OF DISPOSAL

(To be submitted upon completion of Construction pursuant to the contracts Certificate of Completion)

WHEREAS, on the _____ DAY OF _____, 2_____ the undersigned entered into and executed a contract with the City of San Diego, a municipal corporation, for:

(Name of Project or Task)

as particularly described in said contract and identified as Bid No. _____; SAP No. (WBS/IO/CC) _____; and WHEREAS, the specification of said contract requires the Contractor to affirm that "all brush, trash, debris, and surplus materials resulting from this project have been disposed of in a legal manner"; and WHEREAS, said contract has been completed and all surplus materials disposed of:

NOW, THEREFORE, in consideration of the final payment by the City of San Diego to said Contractor under the terms of said contract, the undersigned Contractor, does hereby affirm that all surplus materials as described in said contract have been disposed of at the following location(s)

and that they have been disposed of according to all applicable laws and regulations.

Dated this _____ DAY OF _____, _____.

_____ Contractor

by

ATTEST:

State of _____ County of _____

On this _____ DAY OF _____, 2_____, before the undersigned, a Notary Public in and for said County and State, duly commissioned and sworn, personally appeared _____ known to me to be the _____ Contractor named in the foregoing Release, and whose name is subscribed thereto, and acknowledged to me that said Contractor executed the said Release.

Notary Public in and for said County and State

COMPANY LETTERHEAD
CERTIFICATE OF COMPLIANCE

Materials and Workmanship Compliance

For Contract or Task _____

I certify that the material listed below complies with the materials and workmanship requirements of the Caltrans Contract Plans, Special Provisions, Standard Specifications, and Standard Plans for the contract listed above.

I also certify that I am an official representative for _____, the manufacturer of the material listed above. Furthermore, I certify that where California test methods, physical or chemical test requirements are part of the specifications, that the manufacturer has performed the necessary quality control to substantiate this certification.

Material Description:

Manufacturer: _____
Model: _____
Serial Number (if applicable) _____
Quantity to be supplied: _____
Remarks: _____

Signed by: _____

Printed Name: _____

Title: _____

Company: _____

Date: _____

City of San Diego
Public Works Department, Field Division

NOTICE OF MATERIALS TO BE USED

To: _____ Date: _____, 20____

Resident Engineer

You are hereby notified that the materials required for use under Contract No. _____
 for construction of _____

in the City of San Diego, will be obtained from sources herein designated.

CONTRACT ITEM NO. (Bid Item)	KIND OF MATERIAL (Category)	NAME AND ADDRESS WHERE MATERIAL CAN BE INSPECTED (At Source)

It is requested that you arrange for a sampling, testing, and inspection of the materials prior to delivery, in accordance with Section 4-1.11 of the WHITEBOOK, where it is practicable, and in accordance with your policy. It is understood that source inspection does not relieve the Contractor of full responsibility for incorporating in the work, materials that comply in all respects with the contract plans and specifications, nor does it preclude subsequent rejection of materials found to be undesirable or unsuitable.

Distribution:

Supplier

Yours truly,

 Signature of Supplier

 Address

ELECTRONICALLY SUBMITTED FORMS

**THE FOLLOWING FORMS MUST BE SUBMITTED IN PDF
FORMAT WITH BID SUBMISSION**

The following forms are to be completed by the bidder and submitted (uploaded) electronically with the bid in PlanetBids.

A. BID BOND – See Instructions to Bidders, Bidders Guarantee of Good Faith (Bid Security) for further instructions

B. CONTRACTOR’S CERTIFICATION OF PENDING ACTIONS

C. EQUAL BENEFITS ORDINANCE - CERTIFICATION OF COMPLIANCE

D. CONTRACTOR EXPERIENCE REFERENCE FORM

**Bids will not be accepted until ALL forms are submitted as part
of the bid submittal**

BID BOND

**See Instructions to Bidders, Bidder Guarantee of Good Faith
(Bid Security)**

KNOW ALL MEN BY THESE PRESENTS,

That CALIFORNIA SKATEPARKS as Principal, and
INTERNATIONAL FIDELITY INSURANCE COMPANY as Surety, are

held and firmly bound unto The City of San Diego hereinafter called "OWNER," in the sum of **10% OF THE TOTAL BID AMOUNT** for the payment of which sum, well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS, said Principal has submitted a Bid to said OWNER to perform the WORK required under the bidding schedule(s) of the OWNER's Contract Documents entitled **Park De La Cruz Neighborhood Park Improvements - Phase I Bid No. K-16-1457-DBB-3-A**

NOW THEREFORE, if said Principal is awarded a contract by said OWNER and, within the time and in the manner required in the "Notice Inviting Bids" enters into a written Agreement on the form of agreement bound with said Contract Documents, furnishes the required certificates of insurance, and furnishes the required Performance Bond and Payment Bond, then this obligation shall be null and void, otherwise it shall remain in full force and effect. In the event suit is brought upon this bond by said OWNER and OWNER prevails, said Surety shall pay all costs incurred by said OWNER in such suit, including a reasonable attorney's fee to be fixed by the court.

SIGNED AND SEALED, this _____ 30th day of _____ June,
20 16 _____

CALIFORNIA SKATEPARKS (SEAL)

INTERNATIONAL FIDELITY INSURANCE COMPANY (SEAL)

(Principal)

(Surety)

By: _____

Roger Lovingood / Vice President
(Signature)

By: _____

Gregory Hettiger / Attorney-In-Fact
(Signature)
CA DOI License No. 0B52655

(SEAL AND NOTARIAL ACKNOWLEDGEMENT OF SURETY)

ACKNOWLEDGMENT

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

State of California ^{Colorado}
County of Arapahoe)

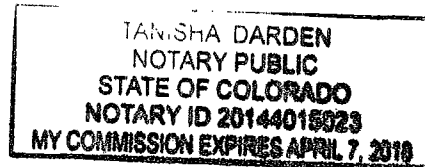
On June 30, 2016 before me, Tanisha Darden
(insert name and title of the officer)

personally appeared Gregory Hettinger
who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California ^{Colorado} that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

Signature  (Seal)



POWER OF ATTORNEY

INTERNATIONAL FIDELITY INSURANCE COMPANY ALLEGHENY CASUALTY COMPANY

ONE NEWARK CENTER, 20TH FLOOR NEWARK, NEW JERSEY 07102-5207

KNOW ALL MEN BY THESE PRESENTS: That INTERNATIONAL FIDELITY INSURANCE COMPANY, a corporation organized and existing under the laws of the State of New Jersey, and ALLEGHENY CASUALTY COMPANY, a corporation organized and existing under the laws of the State of New Jersey, having their principal office in the City of Newark, New Jersey, do hereby constitute and appoint

GREGORY HETTINGER

Greenwood Village, CO

their true and lawful attorney(s)-in-fact to execute, seal and deliver for and on its behalf as surety, any and all bonds and undertakings, contracts of indemnity and other writings obligatory in the nature thereof, which are or may be allowed, required or permitted by law, statute, rule, regulation, contract or otherwise, and the execution of such instrument(s) in pursuance of these presents, shall be as binding upon the said INTERNATIONAL FIDELITY INSURANCE COMPANY and ALLEGHENY CASUALTY COMPANY, as fully and amply, to all intents and purposes, as if the same had been duly executed and acknowledged by their regularly elected officers at their principal offices.

This Power of Attorney is executed and may be revoked pursuant to and by authority of the By-Laws of INTERNATIONAL FIDELITY INSURANCE COMPANY and ALLEGHENY CASUALTY COMPANY and is granted under and by authority of the following resolution adopted by the Board of Directors of INTERNATIONAL FIDELITY INSURANCE COMPANY at a meeting duly held on the 20th day of July, 2010 and by the Board of Directors of ALLEGHENY CASUALTY COMPANY at a meeting duly held on the 15th day of August, 2000:

"RESOLVED, that: (1) the President, Vice President, Chief Executive Officer or Secretary of the Corporation shall have the power to appoint and to revoke the appointments of Attorneys-in-Fact or agents with power and authority as defined or limited in their respective powers of attorney, and to execute on behalf of the Corporation and affix the Corporation's seal thereto, bonds, undertakings, recognizances, contracts of indemnity and other written obligations in the nature thereof or related thereto; and (2) any such Officers of the Corporation may appoint and revoke the appointments of joint-control custodians, agents for acceptance of process, and Attorneys-in-fact with authority to execute waivers and consents on behalf of the Corporation; and (3) the signature of any such Officer of the Corporation and the Corporation's seal may be affixed by facsimile to any power of attorney or certification given for the execution of any bond, undertaking, recognizance, contract of indemnity or other written obligation in the nature thereof or related thereto, such signature and seals when so used whether heretofore or hereafter, being hereby adopted by the Corporation as the original signature of such officer and the original seal of the Corporation, to be valid and binding upon the Corporation with the same force and effect as though manually affixed."

IN WITNESS WHEREOF, INTERNATIONAL FIDELITY INSURANCE COMPANY, and ALLEGHENY CASUALTY COMPANY have each executed and attested these presents on this 31st day of December, 2015.



STATE OF NEW JERSEY
County of Essex

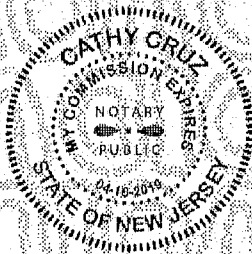
ROBERT W. MINSTER
Chief Executive Officer (International Fidelity Insurance Company) and President (Allegheny Casualty Company)



On this 31st day of December 2015, before me came the individual who executed the preceding instrument, to me personally known, and being by me duly sworn, said he is the therein described and authorized officer of INTERNATIONAL FIDELITY INSURANCE COMPANY and ALLEGHENY CASUALTY COMPANY; that the seals affixed to said instrument are the Corporate Seals of said Companies; that the said Corporate Seals and his signature were duly affixed by order of the Boards of Directors of said Companies.

IN TESTIMONY WHEREOF, I have hereunto set my hand affixed my Official Seal, at the City of Newark, New Jersey the day and year first above written.

A NOTARY PUBLIC OF NEW JERSEY
My Commission Expires April 16, 2019



CERTIFICATION

I, the undersigned officer of INTERNATIONAL FIDELITY INSURANCE COMPANY and ALLEGHENY CASUALTY COMPANY do hereby certify that I have compared the foregoing copy of the Power of Attorney and affidavit and the copy of the Sections of the By-Laws of said Companies as set forth in said Power of Attorney, with the originals on file in the home office of said companies, and that the same are correct transcripts thereof, and of the whole of the said originals, and that the said Power of Attorney has not been revoked and is now in full force and effect.

IN TESTIMONY WHEREOF, I have hereunto set my hand this 30th day of June, 2016.

MARIA BRANCO, Assistant Secretary

CALIFORNIA ALL- PURPOSE CERTIFICATE OF ACKNOWLEDGMENT

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

State of California }

County of San Bernardino }

On June 30, 2016 before me, Misty Trinity Bissman, Notary Public,
(Here insert name and title of the officer)

personally appeared Roger Lovingood,
who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.



Notary Public Signature

(Notary Public Seal)



ADDITIONAL OPTIONAL INFORMATION

DESCRIPTION OF THE ATTACHED DOCUMENT

(Title or description of attached document)

(Title or description of attached document continued)

Number of Pages _____ Document Date _____

CAPACITY CLAIMED BY THE SIGNER

- Individual (s)
 Corporate Officer

(Title)

- Partner(s)
 Attorney-in-Fact
 Trustee(s)
 Other _____

INSTRUCTIONS FOR COMPLETING THIS FORM

This form complies with current California statutes regarding notary wording and, if needed, should be completed and attached to the document. Acknowledgments from other states may be completed for documents being sent to that state so long as the wording does not require the California notary to violate California notary law.

- State and County information must be the State and County where the document signer(s) personally appeared before the notary public for acknowledgment.
- Date of notarization must be the date that the signer(s) personally appeared which must also be the same date the acknowledgment is completed.
- The notary public must print his or her name as it appears within his or her commission followed by a comma and then your title (notary public).
- Print the name(s) of document signer(s) who personally appear at the time of notarization.
- Indicate the correct singular or plural forms by crossing off incorrect forms (i.e. he/she/they- is /are) or circling the correct forms. Failure to correctly indicate this information may lead to rejection of document recording.
- The notary seal impression must be clear and photographically reproducible. Impression must not cover text or lines. If seal impression smudges, re-seal if a sufficient area permits, otherwise complete a different acknowledgment form.
- Signature of the notary public must match the signature on file with the office of the county clerk.
 - ❖ Additional information is not required but could help to ensure this acknowledgment is not misused or attached to a different document.
 - ❖ Indicate title or type of attached document, number of pages and date.
 - ❖ Indicate the capacity claimed by the signer. If the claimed capacity is a corporate officer, indicate the title (i.e. CEO, CFO, Secretary).
- Securely attach this document to the signed document with a staple.

CONTRACTOR'S CERTIFICATION OF PENDING ACTIONS

As part of its bid or proposal (Non-Price Proposal in the case of Design-Build contracts), the Bidder shall provide to the City a list of all instances within the past 10 years where a complaint was filed or pending against the Bidder in a legal or administrative proceeding alleging that Bidder discriminated against its employees, subcontractors, vendors or suppliers, and a description of the status or resolution of that complaint, including any remedial action taken.

CHECK ONE BOX ONLY.

- The undersigned certifies that within the past 10 years the Bidder has NOT been the subject of a complaint or pending action in a legal administrative proceeding alleging that Bidder discriminated against its employees, subcontractors, vendors or suppliers.

- The undersigned certifies that within the past 10 years the Bidder has been the subject of a complaint or pending action in a legal administrative proceeding alleging that Bidder discriminated against its employees, subcontractors, vendors or suppliers. A description of the status or resolution of that complaint, including any remedial action taken and the applicable dates is as follows:

DATE OF CLAIM	LOCATION	DESCRIPTION OF CLAIM	LITIGATION (Y/N)	STATUS	RESOLUTION/REMEDIAL ACTION TAKEN

Contractor Name: California Skateparks

Certified By Joseph M. Ciaglia Jr. Title President

Name

Signature

Date 6/21/16

USE ADDITIONAL FORMS AS NECESSARY

**EQUAL BENEFITS ORDINANCE
CERTIFICATION OF COMPLIANCE**



For additional information, contact:
CITY OF SAN DIEGO

EQUAL BENEFITS PROGRAM

202 C Street, MS 9A, San Diego, CA 92101

COMPANY INFORMATION	
Company Name: California Skateparks	Contact Name: Minerva Larios
Company Address: 273 N. Benson Ave Upland, CA 91786	Contact Phone: 909-949-1601
	Contact Email: mlarios@caglobalservices.com

CONTRACT INFORMATION	
Contract Title: Park De La Cruz Neighborhood Park Improvements - Phase I	Start Date:
Contract Number (if no number, state location): Bid No.: K-16-1457-DBB-3-A	End Date:

SUMMARY OF EQUAL BENEFITS ORDINANCE REQUIREMENTS

The Equal Benefits Ordinance [EBO] requires the City to enter into contracts only with contractors who certify they will provide and maintain equal benefits as defined in SDMC §22.4302 for the duration of the contract. To comply:

- Contractor shall offer equal benefits to employees with spouses and employees with domestic partners.
 - Benefits include health, dental, vision insurance; pension/401(k) plans; bereavement, family, parental leave; discounts, child care; travel/relocation expenses; employee assistance programs; credit union membership; or any other benefit.
 - Any benefit not offer an employee with a spouse, is not required to be offered to an employee with a domestic partner.
- Contractor shall post notice of firm's equal benefits policy in the workplace and notify employees at time of hire and during open enrollment periods.
- Contractor shall allow City access to records, when requested, to confirm compliance with EBO requirements.
- Contractor shall submit *EBO Certification of Compliance*, signed under penalty of perjury, prior to award of contract.

NOTE: This summary is provided for convenience. Full text of the EBO and Rules Implementing the EBO are available at www.sandiego.gov/administration.

CONTRACTOR EQUAL BENEFITS ORDINANCE CERTIFICATION

Please indicate your firm's compliance status with the EBO. The City may request supporting documentation.

I affirm **compliance** with the EBO because my firm (*contractor must select one reason*):

- Provides equal benefits to spouses and domestic partners.
- Provides no benefits to spouses or domestic partners.
- Has no employees.
- Has collective bargaining agreement(s) in place prior to January 1, 2011, that has not been renewed or expired.

I request the City's approval to pay affected employees a cash equivalent in lieu of equal benefits and verify my firm made a reasonable effort but is not able to provide equal benefits upon contract award. I agree to notify employees of the availability of a cash equivalent for benefits available to spouses but not domestic partners and to continue to make every reasonable effort to extend all available benefits to domestic partners.

It is unlawful for any contractor to knowingly submit any false information to the City regarding equal benefits or cash equivalent associated with the execution, award, amendment, or administration of any contract. [San Diego Municipal Code §22.4307(a)] Under penalty of perjury under laws of the State of California, I certify the above information is true and correct. I further certify that my firm understands the requirements of the Equal Benefits Ordinance and will provide and maintain equal benefits for the duration of the contract or pay a cash equivalent if authorized by the City.

Joseph M. Ciaglia Jr. - President 6/21/16

Name/Title of Signatory Signature Date

FOR OFFICIAL CITY USE ONLY		
Receipt Date:	EBO Analyst:	<input type="checkbox"/> Approved <input checked="" type="checkbox"/> Not Approved – Reason:

(Rev 02/15/2011)

**PARK DE LA CRUZ NEIGHBORHOOD PARK IMPROVEMENTS – PHASE I
CONTRACTOR EXPERIENCE REFERENCE FORM**

Your Firm Name California Skateparks

SIMILAR CONSTRUCTION PROJECTS COMPLETED

**Names and references must be current and verifiable
References will be contacted and interviewed**

Copy this sheet as necessary and provide the following information regarding:

Similar project completed within the last five (5) years. One similar project is required to qualify.

Project Completed By (Firm Name): California Skateparks

Project Name: Northeast Regional Park: Skate Park

Location: 5951 Redstone Rim Dr. El Paso, TX 79934

Owner: City of El Paso

Contact: Carlos Adame **Phone:** 915-474-0965 **Email:** adamec1@elpasotexas.gov

Architect or Engineer: Site Design Group

Contact: Cristal Garcia **Phone:** 760-438-2450 **Email:** cristal@sitedesigngroup.com

Construction Manager: Mario Rodriguez **Phone:** 909-949-1601

Description of Project, Scope of Work Performed: The park features a full fledged street plaza with several rails, ledges, stairs, banks and hips. The project also included snake run, a flow bowl with custom cradle, and a competition level in-ground vert bowl with custom pool coping and tile. The project is 23,500 SF in size and was completed in April of 2014. California Skateparks performed all of the work necessary to complete the project including the concrete, metal, coping and tile installation. Certified Nozzleman Jose Lerma completed the shotcrete.

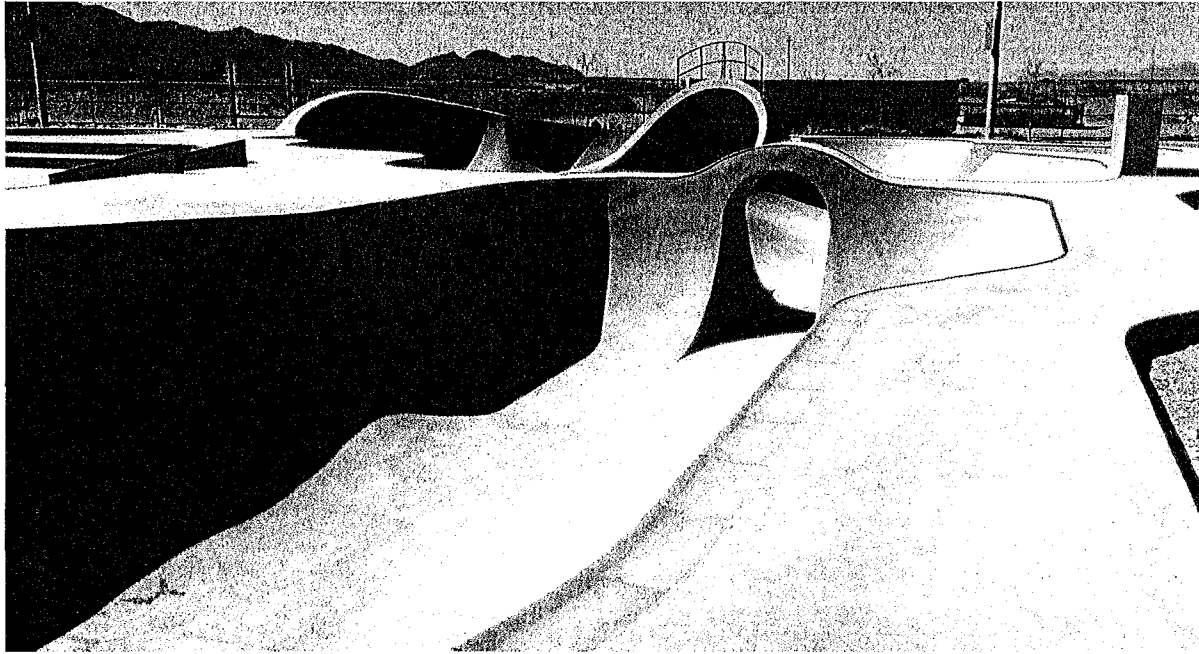
Total Value of Construction (including change orders):* \$628,012.00

Scheduled Completion Date: 04/01/2014 **Actual Completion Date:** 04/01/2014

Extension Time Granted (Number of Days): 0

Phase II Pre-Qualification Submittal Photos

Project Name: NE Regional Park: Skatepark



**PARK DE LA CRUZ NEIGHBORHOOD PARK IMPROVEMENTS – PHASE I
CONTRACTOR EXPERIENCE REFERENCE FORM**

Your Firm Name California Skateparks

SIMILAR CONSTRUCTION PROJECTS COMPLETED

**Names and references must be current and verifiable
References will be contacted and interviewed**

Copy this sheet as necessary and provide the following information regarding:

Similar project completed within the last five (5) years. One similar project is required to qualify.

Project Completed By (Firm Name): California Skateparks

Project Name: Vans Off the Wall Skateparks

Location: 7471 Center Ave, Huntington Beach, CA 92647

Owner: Vans (VF Corporation)

Contact: Sveve Van Doren **Phone:** 562-201-0444 **Email:** steve_van_doren@vfc.com

Architect or Engineer: California Skateparks

Contact: Joe Ciaglia **Phone:** 909-949-1601 **Email:** admin@californiaskateparks.com

Construction Manager: Mario Rodriguez **Phone:** 909-949-1601

Description of Project, Scope of Work Performed: The park was designed and built by CSP and includes a 17,500 SF transition area and 25,000 SF of Street Plaza space. The Transition Area is comprised of a full-sized competition bowl tile and coping and a combo flow course with a "hipped" mini ramp and a backyard pool. The Street Plaza has street elements including stairs, rails, gaps, planter ledges, a double-kinked 40' ft handrail, and a volcano feature with a palm tree in the center. CSPs scope of work included all of the concrete, metal, coping, and tile work. Certified nozzlelemen Jose Lerma completed the shotcrete.

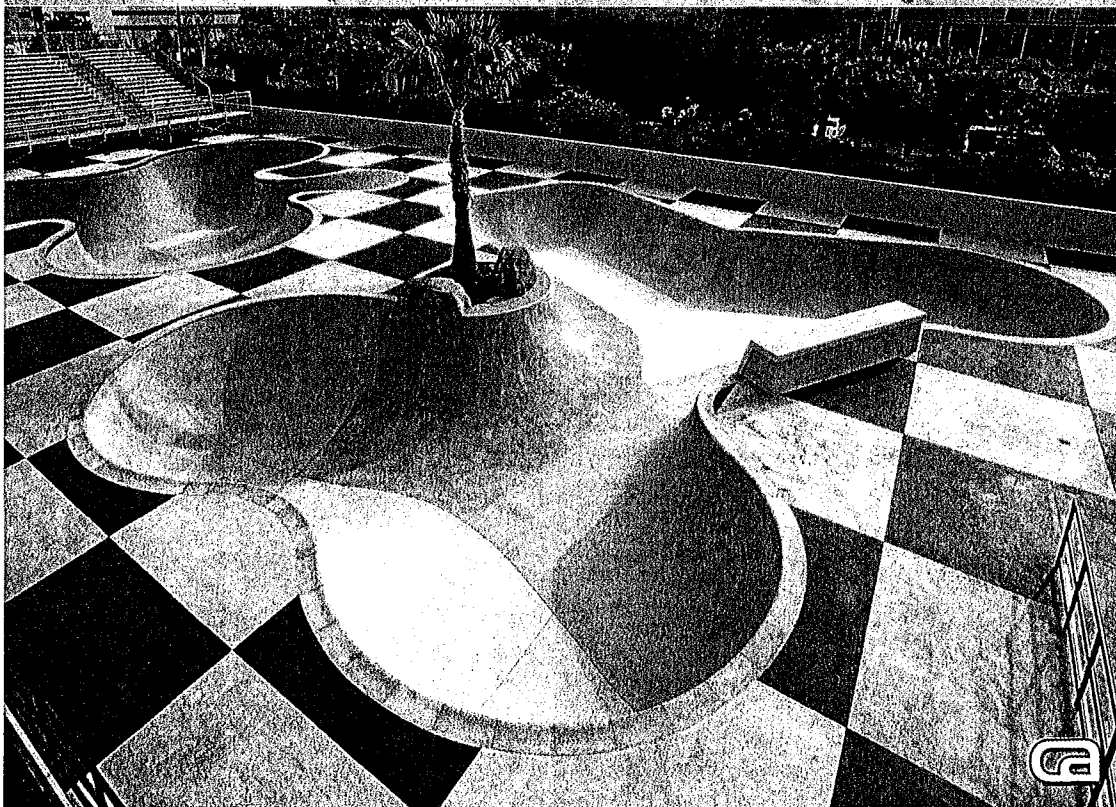
Total Value of Construction (including change orders):* \$2,358,215.93

Scheduled Completion Date: 03/22/2014 **Actual Completion Date:** 03/22/2014

Extension Time Granted (Number of Days): 0

Phase II Pre-Qualification Submittal Photos

Project Name: Vans Off the Wall Skatepark



City of San Diego

CITY CONTACT: Michelle Muñoz, Contract Specialist, Email: MichelleM@sandiego.gov
Phone No. (619) 533-3482, Fax No. (619) 533-3633

ADDENDUM "B"



e - Bidding FOR

Park De La Cruz Neighborhood Park Improvements – Phase I

BID NO.:	K-16-1457-DBB-3-A
SAP NO. (WBS/IO/CC).:	S-15003
CLIENT DEPARTMENT:	1714
COUNCIL DISTRICT:	9
PROJECT TYPE:	GB

BID DUE DATE:

2:00 PM

JUNE 30, 2016

CITY OF SAN DIEGO

PUBLIC WORKS CONTRACTS

1010 SECOND AVENUE, 14th FLOOR, MS 614C

SAN DIEGO, CA 92101

A. CHANGES TO CONTRACT DOCUMENTS

The following changes to the Contract Documents are hereby made effective as though originally issued with the bid package. Bidders are reminded that all previous requirements to this solicitation remain in full force and effect.

B. ATTACHMENTS

1. To Attachment E, Supplementary Special Provisions, page 31, Section 2, Scope and Control of Work, Sub-section 2-3.2, Self Performance, **DELETE** in its entirety and **SUBSTITUTE** with the following:
 1. You must perform, with your own organization, Contract work amounting to at least 30% of the base bid alone or base bid and any additive or deductive alternate(s) that together when added or deducted form the basis of award.

James Nagelvoort, Director
Public Works Department

Dated: *June 24, 2016*
San Diego, California

JN/RWB/egz

City of San Diego

CITY CONTACT: Michelle Muñoz, Contract Specialist, Email: MichelleM@saniego.gov
Phone No. (619) 533-3482, Fax No. (619) 533-3633

ADDENDUM "A"

 **e - Bidding** FOR



Park De La Cruz Neighborhood Park Improvements - Phase I

BID NO.: K-16-1457-DBB-3-A
SAP NO. (WBS/IO/CC): S-15003
CLIENT DEPARTMENT: 1714
COUNCIL DISTRICT: 9
PROJECT TYPE: GB

BID DUE DATE:

2:00 PM

JUNE 30, 2016

CITY OF SAN DIEGO

PUBLIC WORKS CONTRACTS

**1010 SECOND AVENUE, 14th FLOOR, MS 614C
SAN DIEGO, CA 92101**

A. CHANGES TO CONTRACT DOCUMENTS

The following changes to the Contract Documents are hereby made effective as though originally issued with the bid package. Bidders are reminded that all previous requirements to this solicitation remain in full force and effect.

B. INSTRUCTIONS TO BIDDERS

1. To Attachment E, Supplementary Special Provisions, Appendices, Appendix I, Phase II, Pre-Qualification Submittal Requirements and Materials, pages 544 through 546, **DELETE** in its entirety.

James Nagelvoort, Director
Public Works Department

Dated: June 14, 2016
San Diego, California

JN/RWB/egz

Bid Results for Project Park De La Cruz Neighborhood Park Improvements - Phase I (K-16-1457-DBB-3-A)

Issued on 06/09/2016

Bid Due on June 30, 2016 2:00 PM (Pacific)

Exported on 07/01/2016

VendorID	Company Name	Address	City	ZipCode	Contact	Phone	Fax	Email	Vendor Type
314685	California Skateparks	273 N Benson Ave	Upland	91786	Joseph M Claglia Jr	909-949-1601	909-981-9368	joe@californiaskeateparks.com	PQUAL,CADIR

Respondee	Respondee Title	Respondee Phone	Respondee Email
Joseph M. Claglia Jr	President	909-949-1601	admin@californiaskeateparks.com

Bid Format	Submitted Date	Delivery Method	Responsive	Status	Confirmation #	Ranking
Electronic	June 30, 2016 12:07:42 PM (Pacific)			Submitted	83052	0

Attachments		
File Title	File Name	File Type
PDLC Certificate of Pending Action	2016-06-30 PDLC Cert of Pend Actn.pdf	General Attachments
PDLC Equal Benefits Ordinance	2016-06-30 PDLC Equal Ben Ord.pdf	General Attachments
CSP Experience Reference Forms	2016-06-30 PDLC Experience Ref.pdf	General Attachments
PDLC Bid Bond	2016-06-30 PDLC Bid Bond.pdf	Bid Bond

Line Items							
Item Num	Section	Item Code	Description	Unit of Measure	Quantity	Unit Price	Line Total
1	Main Bid	238990	Construction of Park Improvements	LS	1	\$2,876,395.00	\$2,876,395.00
2	Main Bid	524126	Bonds (Payment and Performance)	LS	1	\$46,400.00	\$46,400.00
3	Main Bid	541370	Survey Services	LS	1	\$44,100.00	\$44,100.00
4	Main Bid	236220	Building Permits - EOC Type I	AL	1	\$25,000.00	\$25,000.00
5	Main Bid	238990	Video Recording of Existing Conditions	LS	1	\$1,500.00	\$1,500.00
6	Main Bid	237310	Special Inspection - EOC Type I	AL	1	\$30,000.00	\$30,000.00
7	Main Bid	238990	Mobilization	LS	1	\$153,000.00	\$153,000.00
8	Main Bid		Field Orders - EOC Type II	AL	1	\$180,000.00	\$180,000.00
9	Main Bid	238210	SDG&E Fee Allowance - EOC Type I	AL	1	\$20,000.00	\$20,000.00
10	Main Bid	541330	Water Pollution Control Program Development (SWPPP)	LS	1	\$2,152.50	\$2,152.50
11	Main Bid	238990	Water Pollution Control Program Implementation (SWPPP)	LS	1	\$11,392.50	\$11,392.50
12	Main Bid	541330	SWPPP Permit Fee - EOC TYPE I	AL	1	\$20,000.00	\$20,000.00
						Subtotal	\$3,409,940.00
						Total	\$3,409,940.00

Subcontractors							
Name	Description	License Num	Amount	Type	Address	City	ZipCode
Ace Electric Inc	Constructor, Electrical & Lighting	835109	\$336,515.00	CAU,MALE,PQUAL	6061 Fairmount Ave	San Diego	92120
Construction Fence	Constructor, Wrought Iron Fence	762760	\$225,827.00		3802 Rosecrans Street #232	San Diego	92110
Geocon Incorporated	Constructor, Drainage	506706	\$184,000.00		6960 Flanders Drive	San Diego	92121
Precision Engineering Surveyors, Inc.	Consultant, Surveying & Staking	N/A	\$29,975.00	LAT,MALE,DBE,MBE	7231 Boulder Ave #531	Highland	92346
MTGL, Inc.	Consultant, Engineering & Testing Services	N/A	\$27,015.00	LAT,FEM,DBE,MBE,WOSB	6295 Ferris Square, Suite C	San Diego	92121
G. M. Sager Construction	Constructor, Asphalt Paving & Striping	607796	\$74,117.00		1380 South East End Avenue	Pomona	91766

Self-Performance
74.27%