



CITY *of* CALABASAS

March 20, 2014

Samuel Unger, Executive Officer
Los Angeles Regional Water Quality Control Board
320 West Fourth Street, Suite 200
Los Angeles, California 90013

RE: ADDITIONAL INFORMATION ON MALIBU CREEK WATERSHED EWMP 30 MONTH PROJECTS

Dear Mr. Unger:

This letter is a follow up to a March 17, 2014 telephone conversation between Rebecca Christmann, with the Regional Water Quality Control Board (RWQCB) and me as the Malibu Creek Watershed Enhanced Watershed Management Program (EWMP) Coordinator, in which Ms. Christmann requested additional details on the City of Calabasas' Citywide Smart Irrigation Controller project and City of Westlake Village's Lindero Channel Parkway Improvement project. These two projects were previously submitted to the RWQCB for consideration as the Malibu Creek Watershed Group's 30 month EWMP project, as required by the MS4 Permit, Section VI.C.4.II.(5). Both of these projects have been approved and partially funded by the California Department of Water Resources as viable water quality projects that also meet the criteria outlined in the Greater Los Angeles County Integrated Watershed Management Plan (IRWMP).

The MS4 Permit requires EWMP Groups to fully implement one structural BMP or suite of BMPs at a scale that provides meaningful regional water quality benefits, within 30 months of Permit adoption to show their commitment to develop and implement an EWMP. However, the permit does not require the proposed 30-month project to meet the 85th percentile requirements that will be considered for development of future EWMP structural projects.



We believe both projects committed to by the Malibu Creek EWMP represent a suite of BMPs that provides meaningful water quality improvement. The necessity of these projects was made evident by a study Las Virgenes Municipal Water District (LVMWD) submitted to Metropolitan Water District of Southern California (MWD) in September 2000 titled *Alternative Irrigation Scheduling Methods*, attached herewith. This study was co-funded by MWD (Letter Agreement No. 19139) and demonstrated that 1) irrigating to the evapotranspiration (ET) limit and not further was impossible due to the slope and irrigation design, and 2) that the convex nature of the slope right to the curb causes runoff regardless of the season. To add to the importance of these findings, the observed area was public right-of-way which is irrigated with reclaimed water which is a source of nutrients that could aggravate the watershed's nutrient TMDL, among other concerns. Since the completion of the study, the agencies in the Malibu Creek EWMP have acted on these findings by seeking out grant opportunities and planning multi-year capital improvement projects to improve its landscaped areas and irrigation system.

We recognize that the fact sheets previously submitted may have not been detailed enough to convey the full scope of each project and the associated water quality benefits. With this in mind, we would like to provide you with the below additional details on each project as well as attached supporting documentation:

A. Citywide Smart irrigation Control System

This project calls for installation or replacement of 51 irrigation controllers, and appurtenant structures, within the City of Calabasas public lands including city facilities, parks, street medians and parkways. The project is ready to go out to bid and construction costs are estimated to be \$750,000.

Implementation of the project will require replacing mechanical equipment such as irrigation controllers, excavating trenches to connect to power supply and to run power to new control system, pouring concrete to install pedestals at various locations, replacing valves, installing moisture sensors, adjusting sprinkler heads and programming an internet based weather tracking system to remotely control the timers and automatically adjust watering frequency and duration based on regional weather data. Construction details of these systems are shown at the end of the attached project specifications and the equipment locations are shown on the attached project plans.

This project will provide regional benefits by reducing urban runoff and will reduce discharges of other pollutants transported to the MS4 system by overwatering of landscaped areas. This project will also aid in achieving the MS4 requirement of eliminating non-stormwater runoff.

The City of Calabasas uses 66,431 gallons of water on annual basis for landscape irrigation. It's anticipated that with the new system the City will save between 13,300 to 16,600 gallons of water. In addition to reducing excess irrigation runoff by an estimated 5,000 to 7,000 gallons

per year, it will also enhance the regions self-sufficiency by reducing demand for imported water.

We strongly believe that this is a structural BMP that meets all of the Permit requirements for the Malibu Creek Watershed's EWMP 30 month project. Please see the attached maps for locations of controllers, project specifications and details that shall be provided to future contractor that will be implementing the project in the near future.

B. Lindero Channel Parkway Improvements

Acting on the findings of LVMWD's study, the City of Westlake Village secured a Department of Water Resources (DWR) Prop. 50 grant (Agreement No. 4600007659) in 2010 that provided approximately \$200,000 for a centralized weather based control system for the City's road median and parkway irrigation. In concert with replacing its irrigation system, the City funded the redevelopment of these areas to convert them from convex (crown) to concave (swale) cross-sections to eliminate dry weather flow and capture as much storm flow as possible. The City of Westlake Village has spent in excess of \$2.1 million to replace the irrigation system, install smart controllers, create bio-swales, and plant drought tolerant native plants in all the medians on Lindero Canyon Road, Agoura Road, and Triunfo Canyon Road. As part of this larger capital improvement program of projects, the Lindero Channel Parkway Improvement project alone is estimated to cost \$2.1 million for the scope provided in Attachment 3 of the NOI.

Your November 26, 2013 letter questioned whether the Lindero Channel Parkway Improvement Project was capable of treating the 85th percentile 24-hour storm. On December 12, 2013, we provided your staff with calculations showing that the bio-swales scoped for this project are capable of treating a volume of 1,750 cubic feet of storm flow, that address the net increase in runoff caused by the 85th percentile 24-hour storm. It must be noted that the importance of these bio-swales is NOT because it can treat storm flow caused by a pedestrian pathway, but because it eliminates nuisance flow primarily caused by irrigation utilizing reclaimed water. The unpredictable nature of nuisance flow makes it difficult to estimate a pollutant reduction, but it's safe to say that any quantity of reclaimed water prevented from reaching the MS4 should be enough.

We hope that the above details and technical attachments satisfy the expectation of the RWQCB staff. Please note that the EWMP participating agencies submitted their NOI on June 27, 2013 and have been preparing the EWMP for the past 10 months. Additionally, a draft of the nearly complete Coordinated Integrated Monitoring Plan (CIMP) has been released to stakeholders for review and comment. A public workshop is planned for May 2014 and the final CIMP and EWMP Work Plan will be submitted on time in June 2014.



Please contact me at (818) 224-1680 or via e-mail at afarassati@cityofcalabasas.com should you have any questions about this submittal.

Sincerely,

Alex Farassati, Ph.D.

Malibu Creek Watershed EWMP Coordinator

CC:

Renee Purdy, California Regional Water Quality Control Board, Los Angeles Region
Rebecca Christmann, California Regional Water Quality Control Board, Los Angeles Region
Robert Yalda, City of Calabasas Public Works Director
Kelly Fisher, City of Agoura Hills
Joe Bellomo, Cities of Westlake Village and Hidden Hills
Giles Coons, Los Angeles County Flood Control District

Attachments:

1. Map of Citywide Smart Irrigation Controller System
2. Technical Specifications for Citywide Smart Irrigation Controller System
3. Project benefits for Citywide Smart Irrigation Controller System submitted to DWR
4. Final Report, Letter Agreement No.19139 for Alternative Irrigation Scheduling Methods

CITYWIDE SMART IRRIGATION CONTROLLER SYSTEM

APPENDIX LEGEND:

- IRRIGATION CONTROLLERS - IN SCOPE
- ▲ IRRIGATION CONTROLLERS - NOT IN SCOPE



DIAL TOLL FREE
1-800-422-4133
AT LEAST TWO DAYS
BEFORE YOU DIG

UNDERGROUND SERVICE ALERT (USA)
OF SOUTHERN CALIFORNIA

REVISIONS				
No.	DESCRIPTION	REVISED BY:	APPROVED BY:	DATE

AS-BUILT DRAWING	
I HEREBY CERTIFY THAT THE WORK SHOWN HEREON, MARKED AS 'AS-BUILT', HAS BEEN CONSTRUCTED IN CONFORMANCE WITH LINES AND GRADES AS SHOWN ON SAID PLANS, DRAWINGS, REFERENCED SPECIFICATIONS, AND APPROVED CHANGE ORDERS, AS INDICATED IN THE REVISION BLOCK.	
PROJECT ENGINEER'S SIGNATURE _____	DATE _____
PROJECT ENGINEER'S NAME _____	ENVIRONMENTAL SERVICES MANAGER _____

REVIEWED BY: <u>ALEX FARASSATI</u> IN ACCORDANCE WITH CITY POLICIES AND CONDITIONS OF APPROVAL.	
SIGNATURE _____	DATE _____

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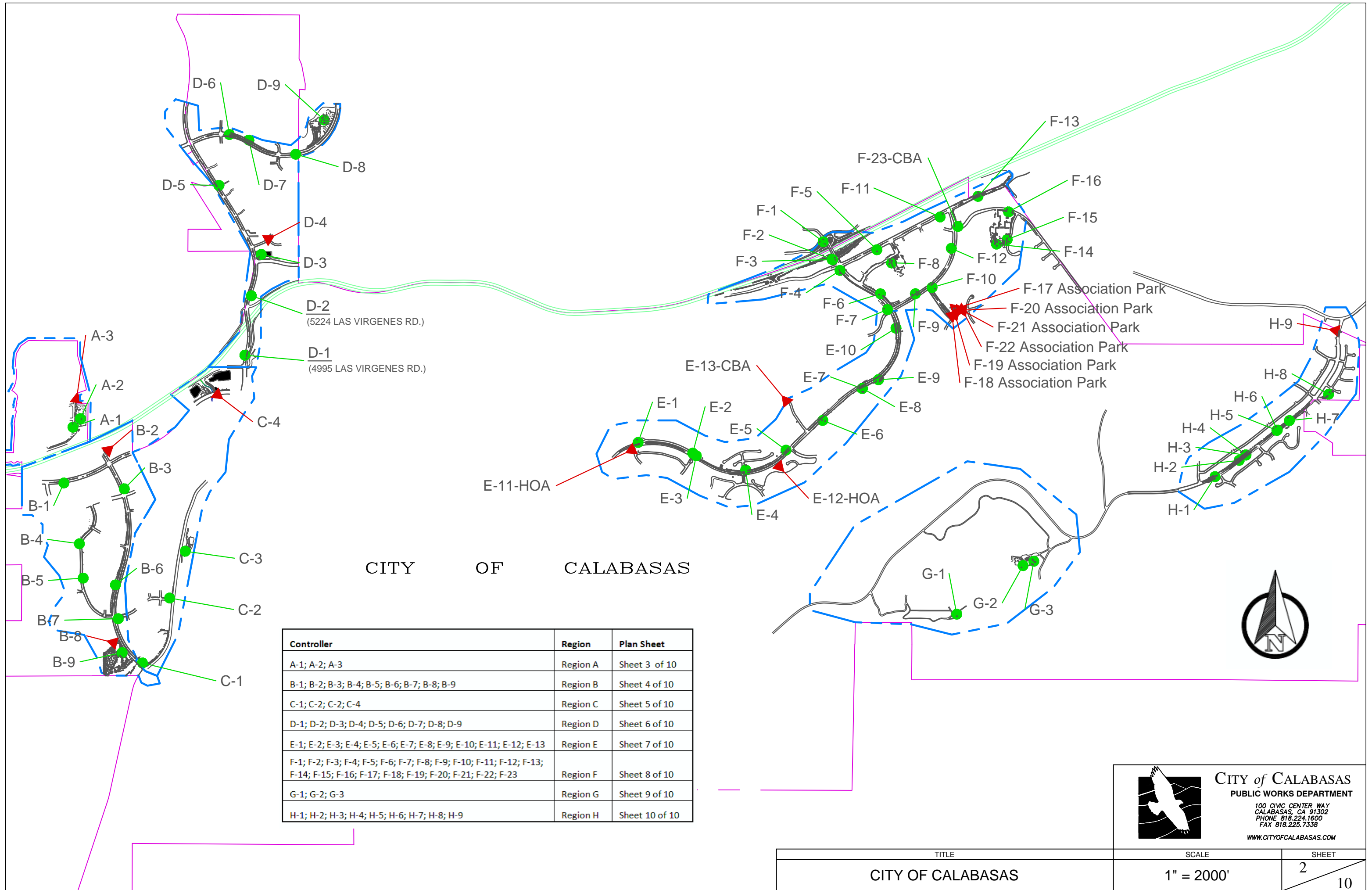
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FAX 818.225.7338
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APPROVED FOR CONSTRUCTION:
ROBERT YALDA, P.E., CITY ENGINEER/PUBLIC WORKS DIRECTOR DATE _____

SMART IRRIGATION PLAN
CITY OF CALABASAS

PREPARED BY: <u>JOEL ORTIZ</u>

PREPARED FOR:	DESIGNED BY: _____
ENVIRONMENTAL SERVICES & LANDSCAPE MAINTENANCE DIVISION	CHECKED BY: _____
	DRAWN BY: _____
	SCALE: <u>N/A</u>
	SHEET NO. <u>1 of 10</u>



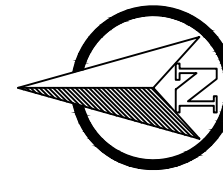
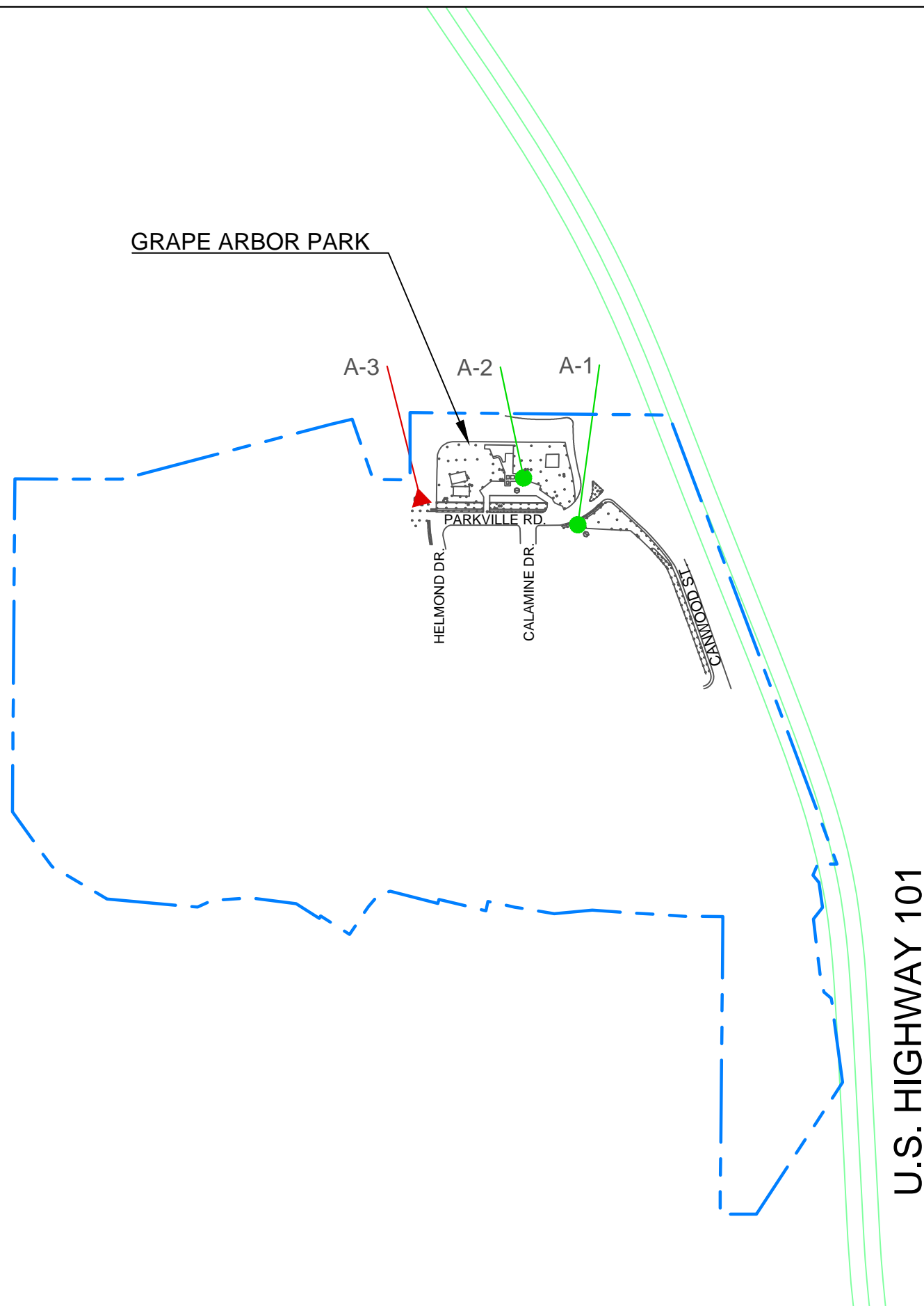
CITY OF CALABASAS

Controller	Region	Plan Sheet
A-1; A-2; A-3	Region A	Sheet 3 of 10
B-1; B-2; B-3; B-4; B-5; B-6; B-7; B-8; B-9	Region B	Sheet 4 of 10
C-1; C-2; C-3; C-4	Region C	Sheet 5 of 10
D-1; D-2; D-3; D-4; D-5; D-6; D-7; D-8; D-9	Region D	Sheet 6 of 10
E-1; E-2; E-3; E-4; E-5; E-6; E-7; E-8; E-9; E-10; E-11; E-12; E-13	Region E	Sheet 7 of 10
F-1; F-2; F-3; F-4; F-5; F-6; F-7; F-8; F-9; F-10; F-11; F-12; F-13; F-14; F-15; F-16; F-17; F-18; F-19; F-20; F-21; F-22; F-23	Region F	Sheet 8 of 10
G-1; G-2; G-3	Region G	Sheet 9 of 10
H-1; H-2; H-3; H-4; H-5; H-6; H-7; H-8; H-9	Region H	Sheet 10 of 10



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TITLE	SCALE	SHEET
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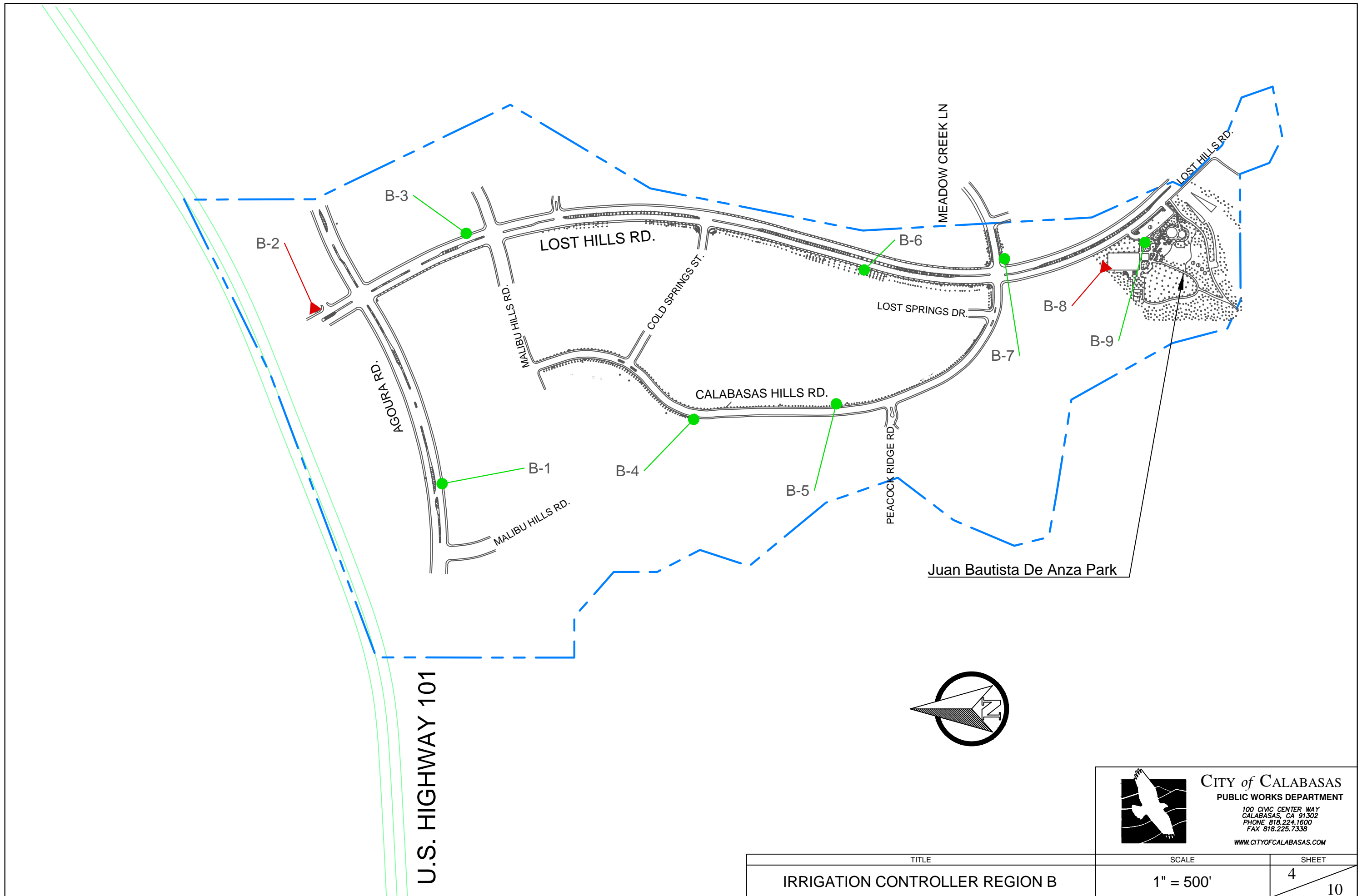


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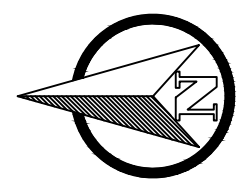
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TITLE	SCALE	SHEET
IRRIGATION CONTROLLER REGION A	1" = 500'	3 10

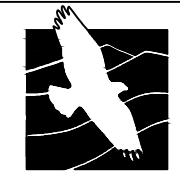
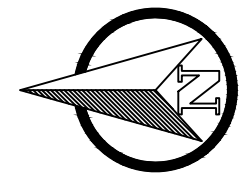
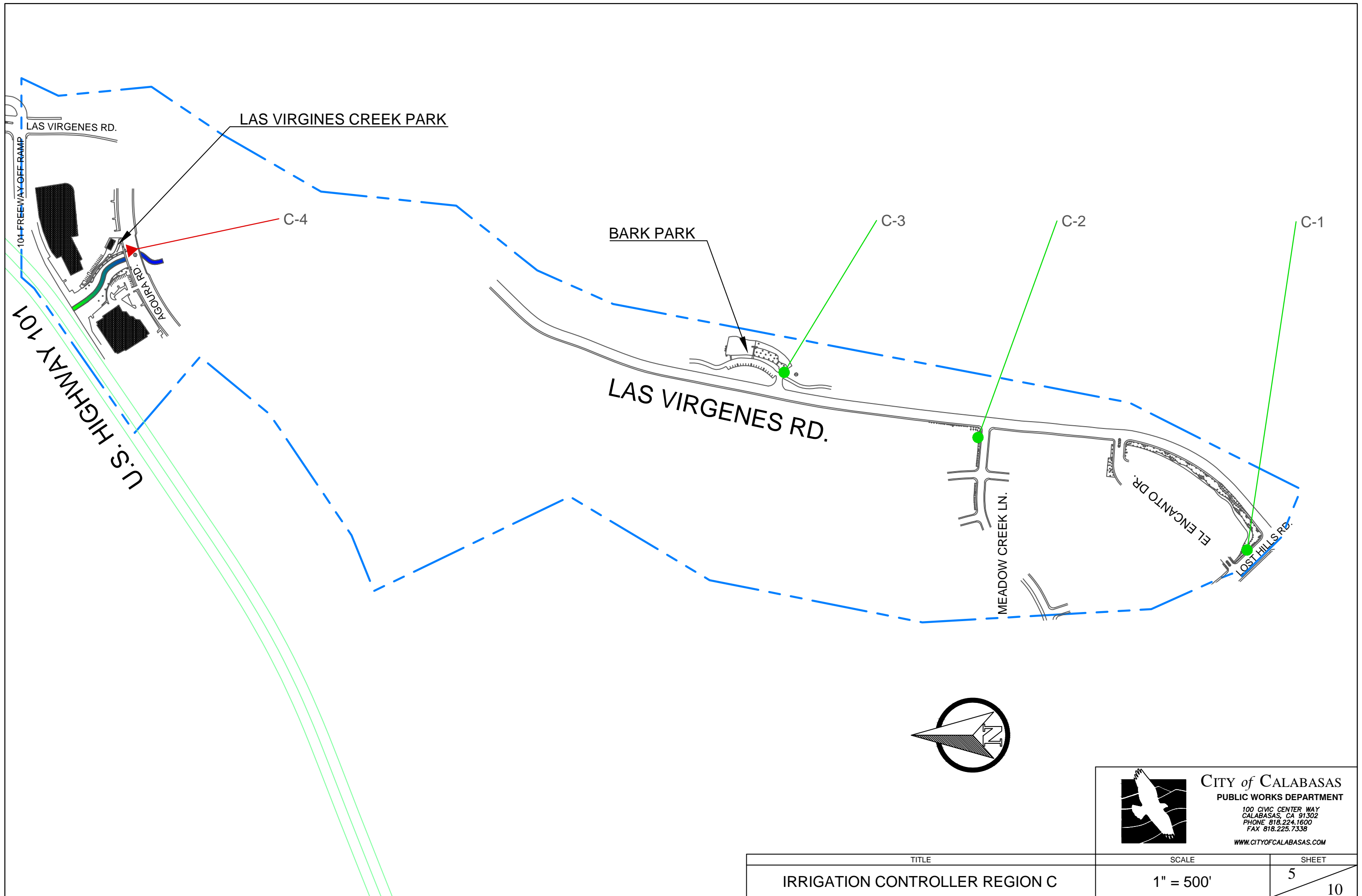


U.S. HIGHWAY 101



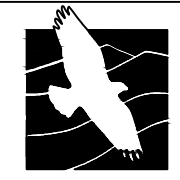
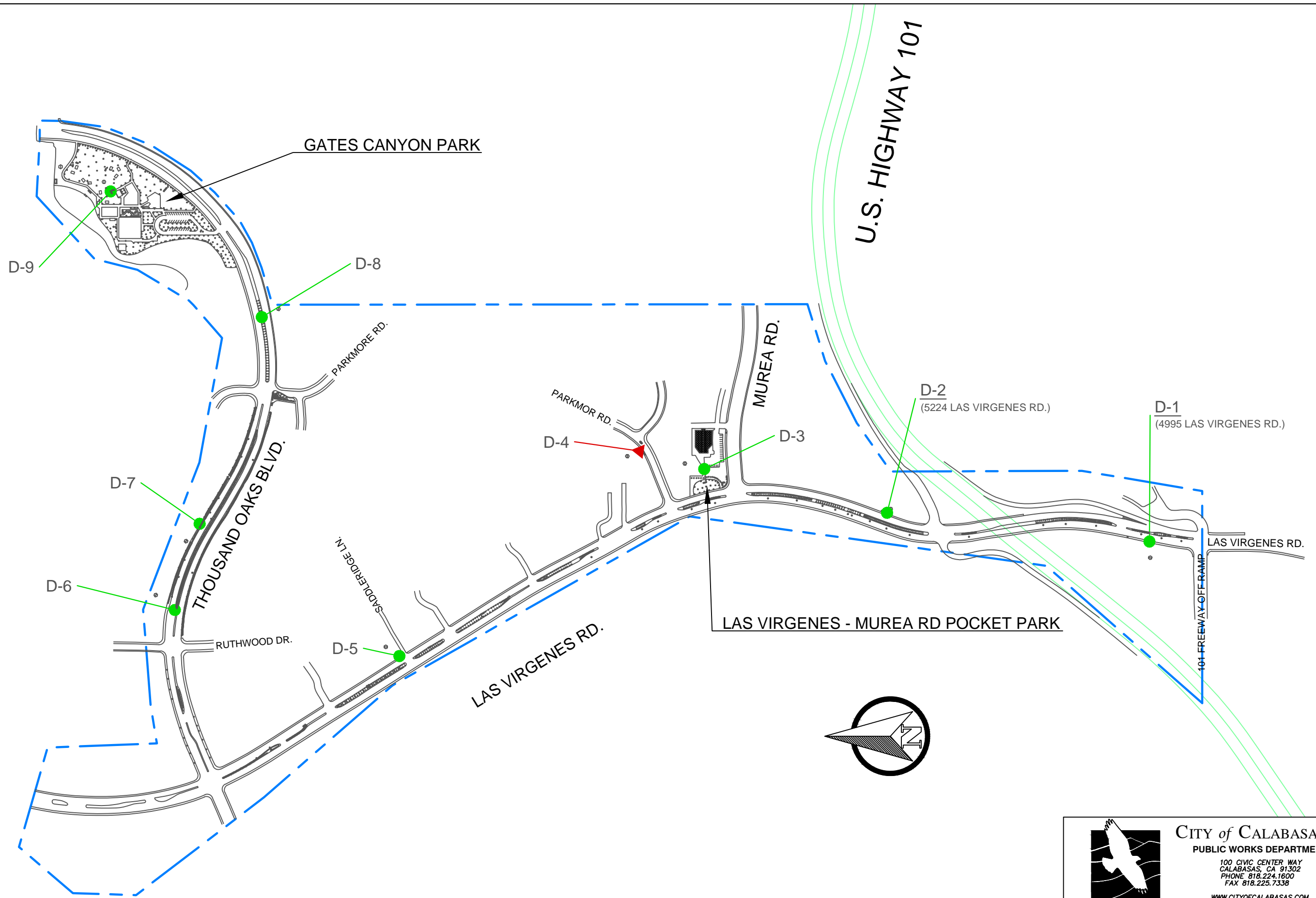

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TITLE	SCALE	SHEET
IRRIGATION CONTROLLER REGION B	1" = 500'	4 / 10



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TITLE	SCALE	SHEET
IRRIGATION CONTROLLER REGION C	1" = 500'	5 10



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TITLE	SCALE	SHEET
IRRIGATION CONTROLLER REGION D	1" = 500'	6 / 10

U.S. HIGHWAY 101

PARK GRANADA

E-10

PARKWAY CALABASAS

E-7

E-9

E-13-CBA

E-6

E-8

PARK ENTRADA

PARKWAY CALABASAS

E-1

PALMILLA DR.

E-2

E-3

E-4

E-5

PASEO PRIMARIO

E-11-HOA

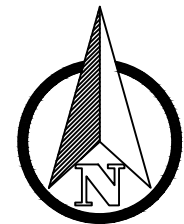
LORENA DR.

ARELLA DR.

PASEO PRIMARIO

PASEO PRIMARIO

E-12-HOA

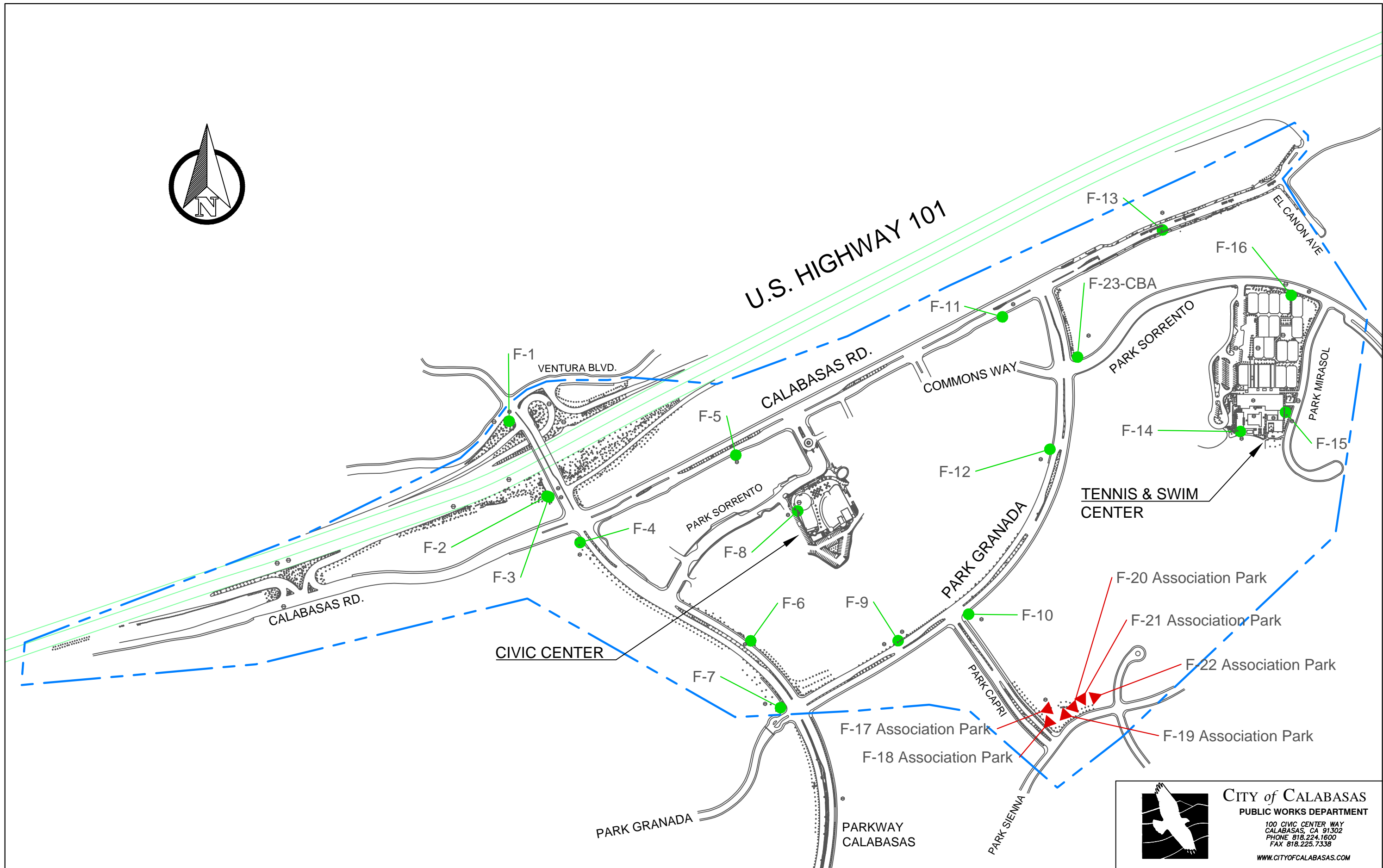
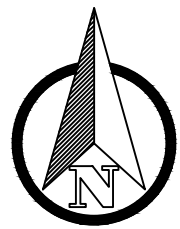


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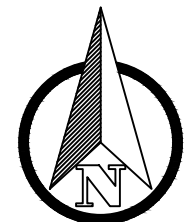
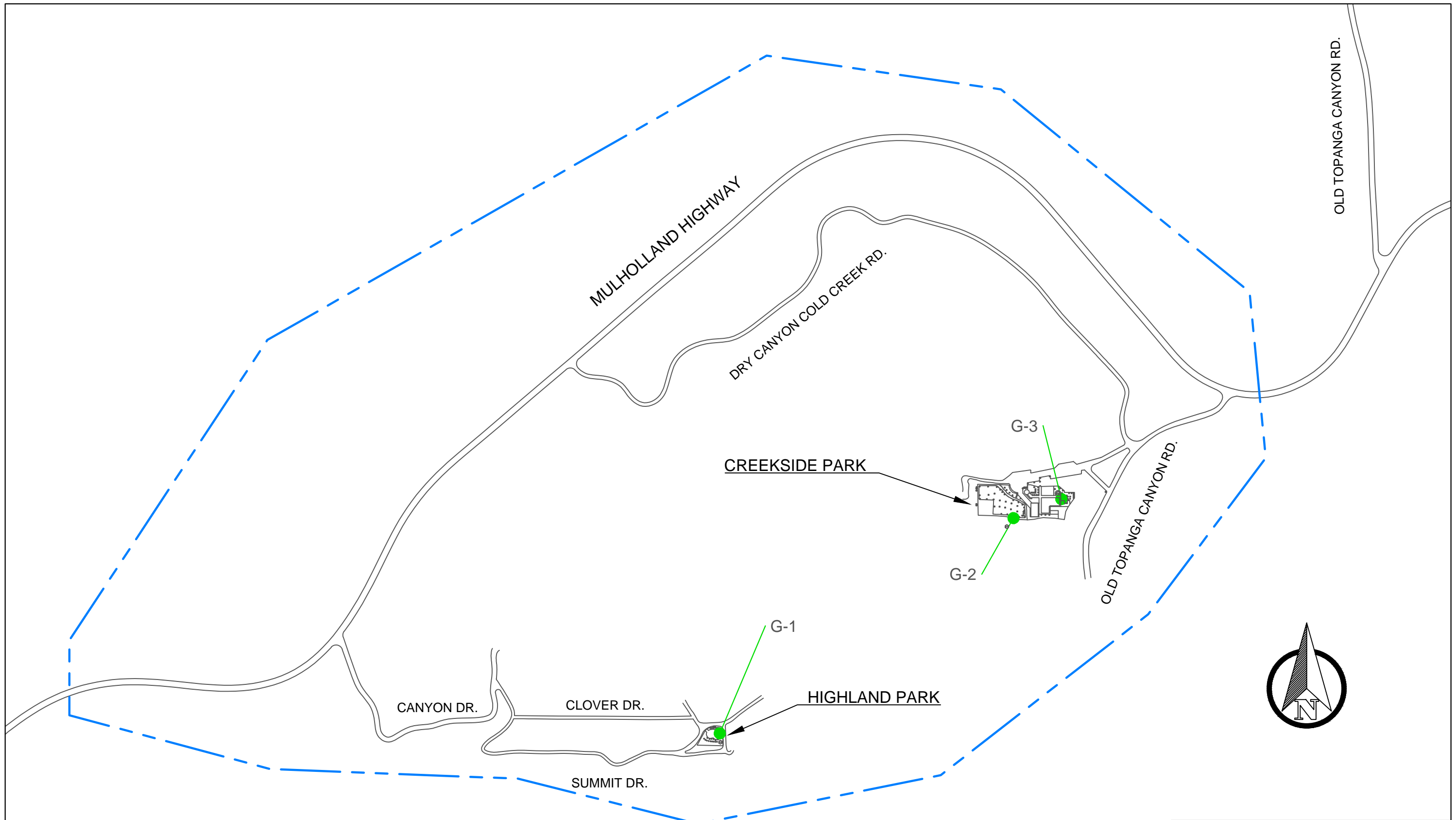

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TITLE	SCALE	SHEET
IRRIGATION CONTROLLER REGION E	1" = 500'	7 10



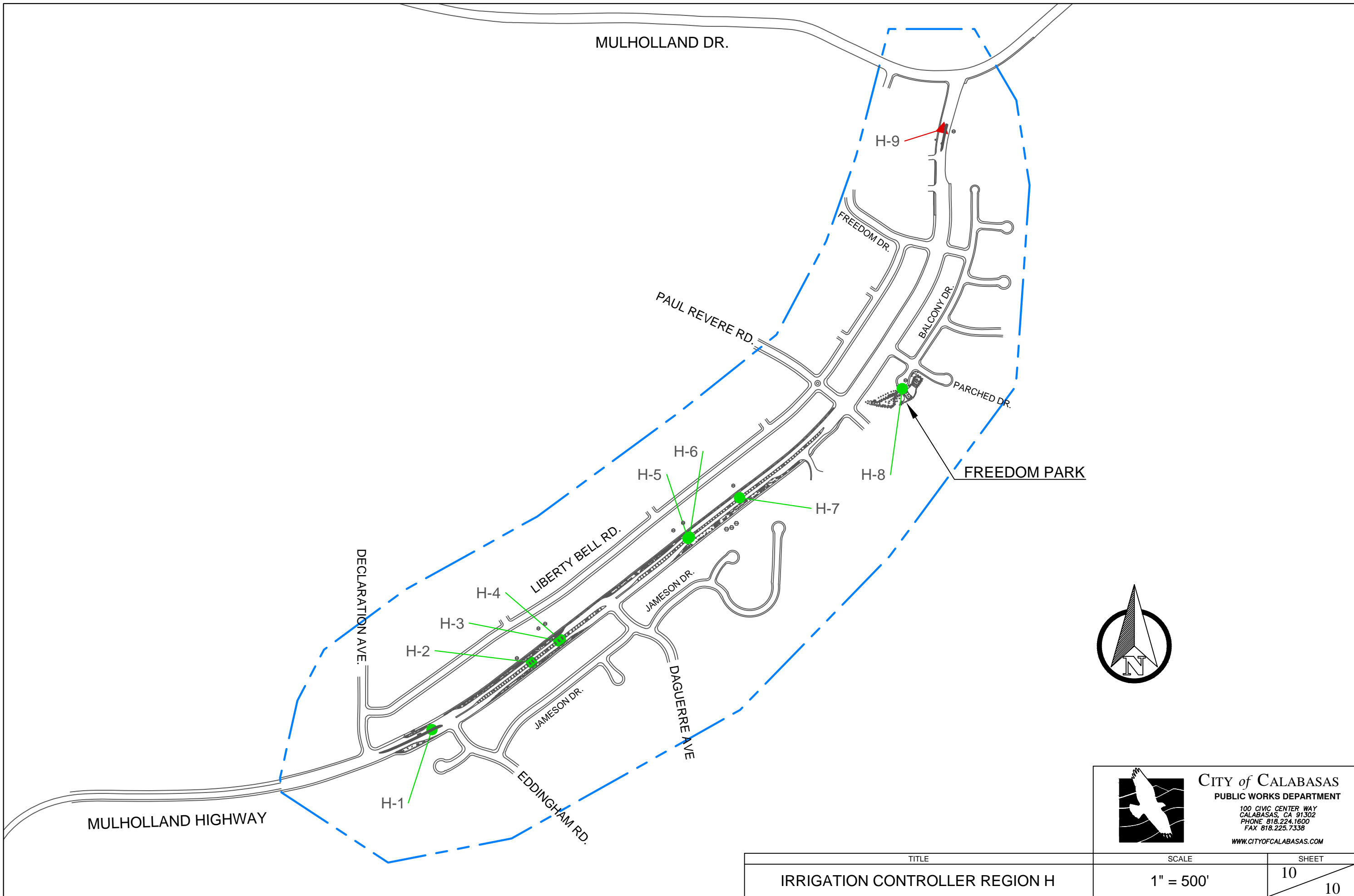
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TITLE	SCALE	SHEET
IRRIGATION CONTROLLER REGION F	1" = 500'	8 10





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TITLE	SCALE	SHEET
IRRIGATION CONTROLLER REGION G	1" = 500'	9 10



TITLE	SCALE	SHEET
IRRIGATION CONTROLLER REGION H	1" = 500'	10 10



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SECTION F – SPECIAL PROVISIONS

SMART IRRIGATION CONTROL SYSTEM PROJECT SPECIFICATION NO. 13-14-03 IN THE CITY OF CALABASAS, CALIFORNIA

SECTION 700 – GENERAL

700-1 LOCATION AND SCOPE OF WORK

The work to be performed under this contract includes flow meters installation and retrofitting of 47 irrigation controller locations to new “smart” irrigation controllers; installation of communication cards on 3 existing controllers to convert them to “smart” irrigation controllers. Several controller locations will be consolidated and others controlled wirelessly on solar power. The new irrigation controllers will be web-based and have the ability to adjust via real time local weather conditions. In addition to the irrigation controller replacement, the work also includes installation of real-time flow sensors at 13 controller locations.

For locations and details of work and equipment refer to **Appendix 1 – Smart Irrigation Controllers Installation Cost by Unit and Appendix 2 – City Flow Sensing and System Components Installation Cost by Unit.**

Contractors shall refer to **Section 706 and Appendix 4 (Installation Details)** for the installation techniques and requirements that the City will expect of the Awarded Contractor.

Upon selection, the Awarded Contractor shall install all new irrigation equipment and remove all existing obsolete equipment per. In addition the Awarded Contractor is to locate all existing Controllers and document all data required in **Appendix 5 (Pre-Installation Checklist and Programming)**, prior to demolition. Contractors should refer to City maps in **Appendix 8** for approximate existing controller locations.

After the new controllers, and potential flow sensors/master valves, are installed, the Award Contractor must complete a **Contractor Certification Checklist (Appendix 6)** for each controller installed. Included in this section is the requirement to activate these controllers on behalf of the City and provide a complete and fully operational web-based Central Control System.

The above summary is only a summary and does not relieve the Contractor from their responsibilities to read and review all documents contained within this Specifications.

700-2 MWD REBATE



The awarded contractor is requested to enroll in the MWD (Metropolitan Water District of Southern California) SoCal Water Smart Contractor Direct Rebate Option and show this as a deduction Bid Item “MWD Rebate for Smart Irrigation Controllers” in the Bid Schedule. This rebate for Weather Based “Smart” Irrigation Controls is at \$25 per station capacity for each location. For the quantities indicated in **Appendix 1**, this rebate amount should be approximately \$21,500.

Participating Contractors will be issued an IRS Form 1099 for total rebates and incentives in excess of \$600 in a calendar year, unless the company is exempt. Funds are limited and contractors may receive direct payments only for applications associated with confirmed reservations, which shall be processed on a first-come, first-served basis. In the unlikely event that SoCal Smart program funds become unavailable, it is the contractors responsibility to notify the City prior to the start of the contract.

SECTION 701 – MOBILIZATION, BONDS, AND INSURANCE

701- 1 GENERAL

The Scope of Work shall consist of all preparatory activities and operations, including but not limited to, insurance, bonds, required permits and fees, shop drawings, storm water pollution prevention plan, moving onto the job (mobilization), moving off the job (demobilization), project phasing, supervision, coordination of concurrent work with other contractors, meetings, and clean-up of work indicated in the Contract Documents.

701-2 MEASUREMENT AND PAYMENT

Measurement and payment for mobilization shall be at the lump sum price bid. The lump sum price bid for mobilization shall not exceed 10% of the total contract amount.

Payments for mobilization will be made in accordance with the following table:

Percent of original contract amount earned	Percent of amount bid for mobilization to be paid
5%	40%
15%	20%
40%	30%
50%	10%



The lump sum price bid for mobilization shall include all labor, materials, tools, and incidentals required to complete mobilization in accordance with the contract documents.

Any other cost of work in advance of construction operations and not directly attributed to any specific bid item shall be included in the Mobilization, Bonds and Insurance Bid item.

SECTION 702 – NOTIFICATION OF PROPERTY OWNERS AND BUSINESSES

702-1 Scope

The Contractor's attention is directed to Section 7-10.1.2 of the Standard Specifications for additional information regarding this item.

702-2 Measurement and Payment

Payment for notification of property owners and businesses shall be included in the bid prices for other items of work and no additional payment will be made. Such payment shall be considered full compensation for furnishing and maintaining all materials, labor, equipment, and all incidentals necessary to complete the work in accordance with the Standard Specifications and these Special Provisions.

SECTION 703 – TRAFFIC CONTROL

703-1 General Requirements

All work required for maintaining and controlling traffic during the construction period shall conform to the applicable provisions of the SSPWC and these modifications herein. All such work shall additionally conform to the CA MUTCD the latest edition issued by the State of California and Caltrans Standard.

The Contractor shall be responsible for preparing traffic control plans for the construction of the work called for on the Plans, in accordance with the Standard Specifications and Special Provisions, to the satisfaction of the Engineer. **Traffic Control plans shall be prepared by a licensed Civil Engineer, registered in the State of California.**

All construction work and traffic control shall be scheduled and constructed to provide for a minimum of inconvenience and a maximum of safety to the public vehicular, bicycle and pedestrian traffic for 24 hours per day until the project is complete.

703-2 Construction Signing

Construction signing shall consist of furnishing, installing, maintaining, and removing construction signs, temporary guide markers, and barricades. Construction signing shall meet the requirement set forth in the Manual on Uniform Traffic Control Devices CA MUTCD, the latest edition and these Special Provisions.

703-3 Access

Access to street intersections, public and private parking lots, commercial businesses, residences, and other public and private properties must be maintained at all times. At least 72 hours in advance of starting any work that may affect the access to private properties, the contractor shall provide written notice to such property owners. Vehicular access to and from commercial and residential driveways and parking lots shall be maintained at all times, except when performing items of work, which cannot be accomplished without access restriction.

When access must be restricted, as determined by the Engineer, it shall occur only for the time period required to accomplish the particular item of work.

703-4 Temporary Guide Markers

Temporary guide markers shall be either portable delineators or fluorescent traffic cones and shall conform to these Special Provisions and CA MUTCD, the latest edition. Only one type of temporary guide marker shall be used at any one time.

703-5 Portable Delineators

The portable delineators shall conform to the CA MUTCD, the latest edition.

703-6 Fluorescent Traffic Cones

Fluorescent traffic cones shall be new or reconditioned, and of good commercial quality flexible material suitable for the purpose intended. The outer section of the portion above the base of the cone shall be a highly pigmented fluorescent orange polyvinyl compound. The overall height of the cone shall be at least 28 inches. The base shall be of sufficient weight and size or shall be anchored in a manner such that the traffic cone will remain in an upright position.

The fluorescent traffic cones shall be spaced as necessary per CA MUTCD, the latest edition.

703-7 Measurement and Payment

Payment for traffic control shall be included in the bid prices for other items of work and no additional payment will be made. Such payment shall be considered full compensation for



furnishing and maintaining all materials, labor, equipment, and all incidentals necessary to complete the work in accordance with the Standard Specifications and these Special Provisions.

SECTION 705 – STORM WATER POLLUTION PREVENTION PROGRAM (SWPPP)

705-1 General

Note: Contractor's attention is also directed to SSPWC, the latest edition, for additional information regarding this item.

The Contractor shall provide a local Storm Water Pollution Prevention Plan (SWPPP), which describes in specific detail the Contractor's program to prevent contamination of the storm water collection system. The program shall address both common construction activities and extraordinary events. The SWPPP shall comply with the City of Calabasas Storm water Standards. A copy of the standards is available for review from the City of Calabasas Storm Water Coordinator; phone 818-224-1600.

The Contractor shall submit three (3) copies of SWPPP one week prior to the pre-construction meeting. **Construction shall not begin until the SWPPP is approved.** The SWPPP shall list Best Management Practices (BMPs) that will address practices for reducing the introduction of pollutants on the jobsite and the containment, collection, and disposal of pollutants that occur on the jobsite.

A suggested sample of local SWPPP and BMPs can be obtained from the following source:

City of Calabasas' Storm Water Pollution Prevention Plan (SWPPP) template -
<http://www.cityofcalabasas.com/environmental/swppp.html>

705-2 Construction

The Contractor shall keep a copy of the approved SWPPP on the job site. The Contractor shall provide continuously at the job site all of the tools, equipment, and materials necessary to implement the SWPPP at all times from the project initiation through completion, including any punchlist or warranty work on the project. At a minimum the following requirements should be met as applicable, the maximum extent practicable, at construction sites regardless of size.

705-2.1 Storm drain system protection

At the first order of work the Contractor shall protect the existing stormwater system from entrance of construction debris and pollutants. Such protection shall include implementing the BMPs as outlined in the SWPPP. Protection shall prohibit the discharge of untreated runoff from temporary or permanent street maintenance/landscape maintenance material and waste

storage areas from entering the storm drain system. Sediment that is generated on the project site shall be retained using structural drainage controls. In addition, the protection system shall have a minimum of three features: 1) a particulate filter of geo-synthetic material securely fastened in place such that it cannot be bypassed without significant physical damage; 2) a prefilter for the particulate filter; and 3) on-hand materials to close off the inlet or opening in the case of a significant pollution spill.

705-2.2 Material management and storage

No construction-related materials, wastes, spills or residues shall be discharged from the project site to streets, drainage facilities or adjacent properties by wind or runoff. All materials and/or equipment storage areas where liquid construction materials are placed shall be protected by a physical barrier capable of containing the entire volume of stored liquid materials. During active construction activities, portions of the barrier may be removed for access. However, the barrier materials must be readily accessible for replacement by onsite construction personnel. The barrier must be in place at all times during the absence of Contractor personnel at the storage site.

705-2.3 Equipment and vehicle maintenance

Non-storm water runoff from equipment and vehicle washing and any other activity shall be contained at the project site. The Contractor shall conform to the guidelines set forth in the City of Calabasas Mobile Car Washing Ordinance. The Contractor shall inspect vehicles and equipment on each day of use. Leaks shall be repaired off-site immediately or the problem vehicle or equipment shall be removed from the project site. If necessary, drip pan should be placed under the paving equipment while not in use to catch and/or contain drips and leaks.

705-2.4 Soil erosion control

Erosion from slopes and channels will be eliminated by implementing BMPs, including but not limited to, limiting or grading scheduled during the wet season, inspecting graded areas during rain events, planting and maintenance of vegetation on slopes, and covering erosion susceptible slopes.

705-2.5 BMP Inspection

The Contractor shall inspect all pollution control BMPs regularly. The Contractor should also repair/replace any damaged or clogged element on a daily basis. During periods of precipitation where any runoff occurs, the system shall be checked twice a day, seven days a week, whether or not any work has been performed. The daily checks shall be between 6 and 9 a.m. and 4 and 8 p.m. The Contractor shall keep a monitoring inspection log of each inspection.

705-2.6 Spill prevention and cleanup plan



The Contractor shall have a spill prevention plan and spill cleanup materials readily available and addressed in the SWPPP. Spills shall be cleaned up immediately using dry methods if possible. Spill cleanup material shall be properly disposed of. Refer to SC-11 Spill Prevention BMP form the California Storm water BMP Handbook for Municipal Activities. Contractor shall keep a record of any spills in the inspection log. In addition, at the end of the project, the Contractor must certify that all contaminated materials have been properly disposed in accordance with the SWPPP.

705-2.7 Asphalt and concrete activities

Asphalt and concrete activities shall be scheduled for dry weather. Contractor shall prohibit saw cutting during a storm event of .25 inches or greater.

705-2.8 Employee BMP Training

Contractor shall train employees and subcontractors on BMP implementation, general good housekeeping, and proper spill containment and cleanup.

705-3 Measurement and Payment

Payment for Storm Water Pollution Prevention Program (SWPPP) shall be included in the bid prices for other items of work and no additional payment will be made. Such payment shall be considered full compensation for furnishing and maintaining all materials, labor, equipment, and all incidentals necessary to complete the work in accordance with the Standard Specifications and these Special Provisions.

SECTION 706 – IRRIGATION SYSTEM

706-1 General

705-1.1 Summary

1. It is the intent of the specifications and details that the finished system is complete in every respect and shall be ready for operation satisfactory to the City.
2. Contractor shall refer to **Appendices 1 and 2** for scope of work.
3. Contractor shall refer to **Appendix 3** for clarification of requested equipment.
4. Contractor shall refer to **Appendix 4** for irrigation installation details.
5. Contractor is required to complete the **Pre-Installation Checklist and Programming sheet (Appendix 5)** for each controller prior to commencing work. Contractor shall

notify the Project Manager if a problem or discrepancy is found in existing system in advance of starting any demolition or installation work.

6. Contractor shall complete the **Contractor Certificate Checklist (Appendix 6)** post installation of controllers. Contractor shall submit a completed checklist to the City prior to the final inspection.
7. Contractor shall complete the activation of the Rain Master iCentral controllers at the direction of the City representative, confirm communication, install all programs, and test.
8. The work shall include all materials, labor, services, transportation, and equipment necessary to perform the work as indicated on the details, in these specifications, and as necessary to complete the contract.

705-1.2 Quality Assurance

1. Provide a lead 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 and the manufacturer's recommended methods of installation and who shall direct all work performed under this section.
2. Manufacturer's directions and detailed drawings shall be followed in all cases where the manufacturer of articles used in this contract furnish directions covering points not shown in the drawings and specifications.
3. All local, municipal, and state laws, rules and regulations governing or relating to any portion of this work are hereby incorporated into and made a part of these specifications, and their provisions shall be carried out by the Contractor. Anything contained in these specifications shall not be construed to conflict with any of the above rules and regulations of the same. However, when these specifications and drawings call for or describe materials, workmanship, or construction of a better quality, higher standard, or larger size than is required by the above rules and regulations, the provisions of these specifications and drawings shall take precedence.
4. All materials supplied for this project shall be new and free from any defects. All defective materials shall be replaced immediately at no additional cost to City.
5. The Contractor shall secure the required licenses and permits including payments of charges and fees, give required notices to public authorities, verify permits secured or arrangements made by others affecting the work of this section.

705-1.3 Submittals

1. Submittals Materials List:
 - 1) After award of contract and before any irrigation system materials are ordered from suppliers or delivered to the job site, submit to the City a complete list of



all irrigation system materials, or processes proposed to be furnished and installed as part of this contract.

- 2) The submittals materials list shall include the following information:
 - a. A title sheet with the job name, the contractor's name, contractor's address and telephone number, submittal date and submittal number.
 - b. An index sheet showing the item number (i.e. 1, 2, 3, etc.); an item description; the manufacturer's name; the item model number and the page(s) in the submittal set that contain the catalog cuts.
 - c. The catalog cuts shall be one or two pages copied from the most recent manufacturer's catalog that indicate the product submitted. Do not submit parts lists, exploded diagrams, price lists or other extra information.
 - d. The catalog cuts shall clearly indicate the manufacturer's name and the item model number. The item model number, all specified options and specified sizes shall be circled on the catalog cuts.
 - e. Submittals for equipment indicated on the legend without manufacturer names, or "as approved", shall contain the manufacturer, Class or Schedule, ASTM numbers and/or other certifications as indicated in these specifications.

- 3) Submittal materials list format requirements:
 - a. Submittals shall be provided as one complete package for the project. Multiple partial submittals will not be reviewed.
 - b. Submittal package shall be stapled or bound in such a way as to allow for disassembly for review processing. Submittals shall not have tabs, tab sheets, spiral binding, or any other type of binding that will interfere with automated copying of submittals.
 - c. Submittal package shall have all pages numbered in the lower right hand corner. Page numbers shall correspond with submittal index.
 - d. Re-submitted packages must be revised to include only the equipment being re-submitted. Equipment previously reviewed and accepted shall not be re-submitted in the materials list/index sheet or in the catalog cut sheet package.

The City's authorized representative will allow no substitutions without prior written acceptance.

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

The City's authorized representative will not review the submittal package unless provided in the format described above.

705-1.3 Existing Conditions

1. The Contractor shall verify and be familiar with the locations, size and detail of points of connection provided as the source of water, and electrical supply to the irrigation system.
2. Prior to cutting into the soil, the Contractor must contact Underground Service Alert of Southern California (a.k.a. DigAlert) at least two (2) working days prior to beginning any digging or excavation work and locate all cables, conduits, sewer septic tanks, and other utilities as are commonly encountered underground and he shall take proper precautions not to damage or disturb such improvements. If a conflict exists between such obstacles and the proposed work, the Contractor shall promptly notify the City who will arrange for relocations. The Contractor will proceed in the same manner if a rock layer or any other such conditions are encountered.
3. The Contractor shall protect all existing utilities and features to remain on and adjacent to the project site during construction. Contractor shall repair, at his own cost; all damage resulting from his operations or negligence.
4. The Contractor shall protect all existing irrigation systems, in areas adjacent to and within the project area of work, from damage due to his operations.
5. Contractor shall notify City's Representative if any existing system is temporarily shut off, capped or modified. Provide 48-hour notice, prior to turning off or modifying any existing irrigation system.
6. The Contractor shall repair or replace all existing irrigation systems, in areas adjacent to and within the project area of work, damaged by the construction of this project. Adjacent irrigation systems shall be made completely operational and provide complete coverage of the existing landscaped areas. All repairs shall be complete to the satisfaction of the City's Representative.
7. If Contractor is required to saw cut and trench through any existing pavement or paving, Contractor shall repair paving with like kind, new concrete or asphalt to match existing paving. Including base materials, paving thickness, and joints.
8. Contractor shall remove all existing irrigation controllers that are to be replaced, and turn over irrigation controllers to City Representative.
9. Contractor shall obtain approval from City Representative prior to trenching wire through the existing landscape.
10. The contractor shall complete the Pre-Installation Checklist and Existing Programming sheet for all controllers that are to be removed and replaced.

705-1.4 Inspections

1. The Contractor shall permit the City's authorized representative to visit and inspect at all times any part of the work and shall provide safe access for such visits.

2. Where the specifications require work to be tested by the Contractor, it shall not be covered over until accepted by the City's authorized representative, and/or governing agencies. The Contractor shall be solely responsible for notifying the City, and governing agencies, a minimum of two (2) working days in advance, where and when the work is ready for testing. Should any work be covered without testing or acceptance, it shall be, if so ordered, uncovered at the Contractor's expense.
3. Inspections will be required for the following at a minimum:
 - a) Pre-construction meeting.
 - b) System layout. Contractor shall stake all major equipment including Controller, Flow Sensor, and Master Valve locations. Locations shall be approved by City representative.
 - c) Test irrigation system at controller for functionality. Test shall be performed with a City representative present.
 - d) Final inspection prior to start of 90-day maintenance period.
 - e) Final acceptance prior to turnover.
4. Site observations and testing will not commence without the field record drawings as prepared by the Irrigation Contractor. Record drawings must complete and up to date for each site visit.
5. Work that fails testing and is not accepted will be retested. For any given location, after two failed tests, each additional test will be at a set rate of \$300. Re-inspection or retesting will be paid by the Irrigation Contractor at no additional expense to City.

705-1.5 Storage and Handling

1. Use all means necessary to protect irrigation system materials before, during, and after installation and to protect the installation work and materials of all other trades. In the event of damage, immediately make all repairs and replacements necessary to the acceptance of the City and at no additional cost to the City.
2. Exercise care in handling, loading, unloading, and storing plastic pipe and fittings under cover until ready to install. Transport plastic pipe only on a vehicle with a bed long enough to allow the pipe to lay flat to avoid undue bending and concentrated external load.

705-1.6 Cleanup and Disposal

1. Dispose of waste, trash, and debris in accordance with applicable laws and ordinances and as prescribed by authorities having jurisdiction. Bury no such waste material and debris on the site. Burning of trash and debris will not be permitted. The Contractor shall remove and dispose of rubbish and debris generated by his work and workmen at frequent intervals or when ordered to do so by the City's authorized representative.

2. At the time of completion the entire site will be cleared of tools, equipment, rubbish and debris which shall be disposed of off-site in a legal disposal area.

705-1.7 Turnover Items

3. Record Drawings:
 - 1) Record accurately on one set of drawings all equipment locations, wire path runs, and conduit locations as indicated below.
 - 2) The record drawings shall be prepared to the satisfaction of the City. Prior to final inspection of work, submit record drawings to the City's authorized representative.
 - 3) All record drawings shall be prepared using AutoCAD 2010 drafting software and the original irrigation drawings as a base. No manual drafted record drawings shall be acceptable. The Contractor may obtain digital base files from the City's authorized representative.
 - 4) All digital files shall be provided on a compact disc (CD) clearly marked with the project name, file descriptions and date.
 - a. Record drawing information and dimensions shall be collected on a day-to-day basis during the installation. Locations for all irrigation equipment shall be collected prior to the final inspection of the work.
 - b. Two dimensions from two permanent points of reference such as buildings, sidewalks, curbs, streetlights, hydrants, etc. shall be shown for each piece of irrigation equipment shown below. Where multiple components are installed with no reasonable reference point between the components, dimensioning may be made to the irrigation equipment. All irrigation symbols shall be clearly shown. All lettering on the record drawings shall be minimum 1/8 inch in size.
 - 5) Show locations and depths of the following items:
 - a. Point of connection (including water POC, backflow devices, master control valves, flow sensors, etc.).
 - b. Routing of control wires, pull boxes and conduit.
 - c. Irrigation controllers (indicate controller number and station count).
 - d. Related equipment (as may be directed).
4. Operation and Maintenance Manuals:
 - 1) Two individually bound copies of operation and maintenance manuals shall be delivered to the Irrigation Consultant or City's authorized representative at least 10 calendar days prior to final inspection. The manuals shall describe the material installed and the proper operation of the system.
 - 2) Each complete, bound manual shall include the following information:

- 3) Index sheet stating Contractor's address and telephone number, duration of guarantee period, list of equipment including names and addresses of local manufacturer representatives.
 - a. Operating and maintenance instructions for all equipment.
 - b. Spare parts lists and related manufacturer information for all equipment.
5. Equipment:
 - 1) As a part of this contract provide two keys for each automatic controller.
 - 2) The above equipment shall be turned over to City's authorized representative at the final inspection.

705-1.8 Completion

1. At the time of the pre-maintenance period inspection, the City's authorized representative, and governing agencies will inspect the work, and if not accepted, will prepare a list of items to be completed by the Contractor. Punch list to be checked off by contractor and submitted to City's authorized representative prior to any follow-up meeting. This checked off list to indicate that all punch list items have been completed. At the time of the post-maintenance period or final inspection the work will be re-inspected and final acceptance will be in writing by the City's authorized representative, and governing agencies.
2. The Contractor shall fully guarantee the operation of the control system for a period of 90-days after the pre-maintenance inspection has been completed and approved as stated above. This 90-day maintenance period shall include all that is required to ensure reliable operation of the Rain Master iCentral control system, master valves, and flows sensors as approved by the owner.
3. The City's authorized representative shall have final authority on all portions of the work.
4. After the system has been completed, the Contractor shall instruct City's authorized representative in the operation and maintenance of the irrigation control system and shall furnish a complete set of operating and maintenance instructions.
5. Any settling of trenches which may occur during the one-year period following acceptance shall be repaired to the City's satisfaction by the Contractor without any additional expense to the City. Repairs shall include the complete restoration of all damage to planting, paving or other improvements of any kind as a result of the work.

705-1.9 Guarantee



1. All work done under this contract, shall be unconditionally guaranteed against all defects and fault of material and workmanship, including settling of backfilled areas below grade, for a period of one (1) year following the filing of the Notice of Completion.
2. Should any problem with the irrigation control system be discovered within the guarantee period, it shall be corrected by the Contractor at no additional expense to City within ten (10) calendar days of receipt of written notice from City. When the nature of the repairs as determined by the City constitute an emergency (i.e. broken pressure line) the City may proceed to make repairs at the Contractor's expense. Any and all damages to existing improvement resulting either from faulty materials or workmanship, or from the necessary repairs to correct same, shall be repaired to the satisfaction of the City by the Contractor, all at no additional cost to the City.
3. Guarantee shall be submitted on Contractors own letterhead as follows:

GUARANTEE FOR IRRIGATION CONTROL SYSTEM

We hereby guarantee that the irrigation control system we have furnished and installed is free from defects in materials and workmanship, and the work has been completed in accordance with the drawings and specifications, ordinary wear and tear and unusual abuse, or neglect excepted. We agree to repair or replace any defective material during the period of one year from date of filing of the Notice of Completion and also to repair or replace any damage resulting from the repairing or replacing of such defects at no additional cost to the City. We shall make such repairs or replacements within 10 calendar days following written notification by the City. In the event of our failure to make such repairs or replacements within the time specified after receipt of written notice from City, we authorize the City to proceed to have said repairs or replacements made at our expense and we will pay the costs and charges therefore upon demand.

PROJECT NAME:

PROJECT LOCATION:

CONTRACTOR NAME:

ADDRESS:

TELEPHONE:

SIGNED:

DATE:

706-2 Materials

706-2.1 Summary

Use only new materials of the manufacturer, size and type shown in the specifications. Materials or equipment installed or furnished that do not meet City's, or governing agencies standards will be rejected and shall be removed from the site at no expense to the City.

706-2.2 *Pipe-as needed for flow sensor, master valve, and to fix any breaks*

1. Pressure supply lines 2 inches in diameter and up to 3" inches in diameter downstream of backflow prevention unit shall be Class 315 solvent weld PVC. Piping shall conform to ASTM D2241.
2. Recycled water PVC pipe to be color-coded purple in color marked on two sides with recycled water warning statements "Caution-Recycled Water". Recycled water piping must be accepted by the local recycled water governing agencies.

706-2.2 *Metal Pipe and Fittings Pipe-as needed for flow sensor, master valve, and to fix any breaks*

1. Brass pipe shall be 85 percent red brass, ANSI, IPS Standard 125 pounds, Schedule 40 screwed pipe.
2. Fittings shall be medium brass, screwed 125-pound class.
3. Copper pipe and fittings shall be Type "K" sweat soldered.

706-2.3 *Plastic Pipe and Fittings Pipe-as needed for flow sensor, master valve, and to fix any breaks*

1. Pipe shall be marked continuously with manufacturer's name, nominal pipe size, schedule or class, PVC type and grade, National Sanitation Foundation approval, Commercial Standards designation, and date of extrusion.
2. All plastic pipe shall be extruded of an improved PVC virgin pipe compound in accordance with ASTM D2672, ASTM D2241 or ASTM D1785.
3. All solvent weld PVC fittings shall be standard weight Schedule 40 (and Schedule 80 where specified on the irrigation detail sheet, all mainline fittings shall be Schedule 80 PVC) and shall be injection molded of an improved virgin PVC fitting compound. Slip PVC fittings shall be the "deep socket" bracketed type. Threaded plastic fittings shall be injection molded. All tees and ells shall be side gated. All fittings shall conform to ASTM D2464 and ASTM D2466.

4. All threaded nipples shall be standard weight Schedule 80 with molded threads and shall conform to ASTM D1785.
5. All solvent cementing of plastic pipe and fittings shall be a two-step process, using primer and solvent cement applied per the manufacturer's recommendations. Cement shall be of a fluid consistency, not gel-like or ropy. Solvent cementing shall be in conformance with ASTM D2564 and ASTM D2855.
6. When connection is plastic to metal, female adapters shall be hand tightened, plus one turn with a strap wrench. Joint compound shall be non-lead base Teflon paste, tape, or equal.
7. All pressure mainlines shall be installed with solvent weld SCH. 80 PVC fittings and be installed with concrete thrust blocking at all directional changes in the mainline routing. Concrete thrust blocking shall not be required when ductile iron fittings and mechanical restraints are specified.

706-2.4 Flow Sensing

- a) The flow sensor shall be an in-line type with a non-magnetic, spinning impeller (paddle wheel) as the only moving part.
- b) The electronics housing shall be glass-filled PPS (Polyphenylene Sulfide).
- c) The impeller shall be glass-filled nylon or Tefzel® with a UHMWPE (Ultra-High Molecular Weight Polyethylene) or Tefzel® sleeve bearing.
- d) The shaft material shall be tungsten carbide.
- e) The electronics housing shall have two ethylene-propylene O-Rings and shall be easily removed from the meter body.
- f) The sensor electronics shall be potted in an epoxy compound designed for prolonged immersion.
- g) Electrical connections shall be 2 single conductor 18 AWG leads 48 inches long.
- h) Insulation shall be direct burial UF (Underground Feeder) type colored WHITE for the positive lead and BLACK for the negative lead.
- i) The sensor shall operate in line pressures up to 200 PSI (Pounds per Square Inch) and liquid temperatures up to 140° F, and operate in flows of 0.5 to 30 feet per second with linearity of $\pm 0.7\%$ and repeatability of $\pm 0.7\%$.
- j) The meter body shall be fabricated from bronze tee and preset to a specific sensor height.
- k) There must be free, unrestricted pipe for at least 10 diameters upstream and 5 diameters downstream of the tee.
- l) These flow sensors are Rain Master Irrigation Systems Part Numbers: FS-B100, FS-B150, and FS-B200.

706-2.5 Master Valve

- 1) The master valve shall be brass, normally open Superior 3100/3100DWG model, size as specified in **Appendix 2**.
- 2) Two-piece upper diaphragm and lower seat assembly maximizes flow through valve and protects diaphragm from harmful debris.
- 3) Normally Open design allows for constant system pressurization and on-demand access to manual irrigation and quick coupler use.
- 4) Dirty water protection is afforded by the removable filter and metering rod assembly plus the added benefit of non-continuous flow through the solenoid.
- 5) All EPDM rubber parts outlast commonly used Buna-N parts when exposed to reclaimed water.

706-2.6 Valve Boxes

1. Valve boxes shall be fabricated from a durable, weather-resistant plastic material resistant to sunlight and chemical action of soils.
2. The valve box cover shall be green in color and secured with a hidden latch mechanism or bolts.
3. The cover and box shall be capable of sustaining a load of 1,500 pounds.
4. Valve box extensions shall be by the same manufacturer as the valve box.
5. The plastic irrigation valve box cover shall be an overlapping type.
6. Automatic control valve, master valve, flow sensor, and gate/ball valve boxes shall be 17"x11"x12" 'nominal' rectangular size. Valve box covers shall be marked "RCV" with the valve identification number, or "MV", "FS", "heat branded" onto the cover in 1-1/4 inch high letters / numbers.
7. Valve box cover shall be green in color for potable water or purple for recycled water and permanently marked (attached tags are not acceptable) on valve box cover plate with the words "Warning-Recycled Water-Do Not Drink".
8. NDS PRO AND PRO PLUS SERIES.

706-2.7 Automatic Controller

1. Automatic controller shall be of the manufacturer, size, and type indicated in **Appendices 1 and 2**.
2. Controller enclosure shall be of the manufacturer, size, and type indicated in **Appendices 1 and 2**.
3. Controller shall be grounded according to local codes using equipment of the manufacturer, size, and type indicated on the drawings; or as required by local codes and ordinances.
4. Controllers shall be Rain Master iCentral as specified in **Appendix 1**.
5. JOHN DEERE GREEN TECH-RAIN MASTER EAGLE PLUS ICENTRAL SATELLITE ASSEMBLIES:
Conventional Configuration

- a) Modular station design that allows station counts from 8 stations up to 48 stations in increments of 8 stations.
- b) 8 independently controllable irrigation programs.
- c) Cycle and Soak capability allows virtually unlimited start times allowing stations to start/pause/restart independently until their designated runtimes have been fulfilled.

6. Standard Programming Capability

The key features offered by the controller are:

- a) Programmable Runtimes for each station can be set from 1 minute to 23 hrs 59 minutes.
- b) Programmable delay time between station execution. The programmed delay time can be from 0 to 19 minutes and 59 seconds.
- c) Programmable Total runtime, Maximum Cycle runtime, and Soak time on a per station basis.
- d) Programmable pump activation independent of the master valve on a per program basis.
- e) Programmable stacking or non-stacking operation on a per program basis.
- f) Provides the ability to select either ODD or EVEN day watering on a per program basis.
- g) Water Days for each program can be based on a 14-day cycle or a skip-by-day cycle. The Water Days can be further restricted with the selection of ODD/EVEN calendar days.
- h) Programmable water window setup option to ensure watering takes place only in a pre-defined watering period.
- i) Selectable cycle and soak irrigation programming or conventional programming on a per-program basis.
- j) Cycle and Soak capability allows virtually unlimited cycle times allowing stations to start, pause, and restart independently until their designated runtimes have been fulfilled.
- k) The Cycle and Soak feature intelligently displays the total runtime of the program.
- l) Displays the total runtime of a program. The controller considers all soak delays, water budget percentage, daily ET percentage adjustments, and inter-station delays.
- m) A copy function permitting an entire program to be copied to another program, or an individual runtime to be copied to any station or any sequential block of stations within any program.
- n) Each program can be individually configured as an irrigation or non-irrigation program.

7. Manual Watering

- a) Manual Water Off feature provides a means to quickly turn off all irrigation programs without disturbing the stored programs. Programs that are setup as non-irrigation programs will continue to operate as scheduled.
- b) Manually activated system check (test cycle) to sequentially run each station for a user defined time period from 1 to 59 minutes.
- c) Manually activated program to execute a program independently of its programmed start time and water days.
- d) Manually activate up to 6 stations simultaneously for a user defined time period from 1 minute to 23 hours 59 minutes.

8. Water Conservation Features - Automatic Watering

The controller features the following water conservation features:

- 1) Evapotranspiration (ET) based scheduling selectable on a per program basis.
- 2) Percentage adjustment on a per program basis to allow an increase or decrease of all station runtimes within that program. The percentage allows adjustment from 0 to 300 in 1% increments; this percent adjustment is applied to the runtime.
- 3) Re-calculated station run times are executed to the nearest second.
- 4) Programmable rain shut off in order to delay the start of irrigation after a rainstorm. The controller does not water during the programmed delay period (from 1 to 9 days). After the delay period has expired, the controller returns to the automatic mode of operation.
- 5) Automatic minimization of the water window by intelligently scheduling station starts when other stations are satisfying their Soak Times.
- 6) Automatic monitoring and display of measured station flow.
- 7) Ability to intelligently monitor any dry contact sensor such as: rain, freeze, rain/freeze, moisture, and wind on a per program basis. When the sensor is active, irrigation stops and the display indicates that the sensor is active. This feature allows non-irrigation programs such as lighting controls to execute independent of these devices.
- 8) A water usage reading indicates total water used by the controller on a per month basis. Up to one year worth of data shall be maintained.

9. Convenience Features

- 1) 20 character x 4 line LCD backlit display and 3 embedded LEDs: Alarms, Irrigation active and Water off (Rain shutdown) modes.
- 2) An intuitive user interface utilizing an optical encoder with integrated entry function that allows the user to select options that are presented in the LCD display.
- 3) During program execution, the controller displays the active program number, the flow in GPM, and the station runtime countdown in hours, minutes and seconds (Flow sensor required to display flow).

- 4) Multi-Level 4-Digit Controller Security Access code can be used to prevent unauthorized use or modifications of the controller's programs.
- 5) Restricted: No Program or Setup changes without entering the access code, but permits manual operation as well as Review and Water Off functions.
- 6) No Access: The user cannot perform any operation without entering the access code
- 7) Review key to display current controller operations.

10. Regional Settings

- 1) The date may be displayed in MM/DD/YY (default) or DD/MM/YY format.
- 2) The time may be displayed in 12 or 24 hour clock format.

11. Diagnostic and Fault Detection

The controller supports extensive diagnostics and fault detection capability:

- 1) The display reports the fault conditions. The visual Alarm LED indicator illuminates and an audible chirp (enabled/disabled in setup) is also generated until all faults are cleared.
- 2) The controller automatically maintains a historical list of up to 220 alarms in chronological order.
- 3) Automatic field wire fault detection enables the controller to sense a short in the field wire and instantly turn off that station. The controller will automatically advance past the faulty station to the next programmed station.
- 4) Automatic detection of main line water breaks. In the event of a main line break, the controller shutdown all active irrigation, de-energizes a normally-closed master valve or energizes a normally-open master valve, condemns any future start times, triggers audible (if enabled) and visual alarm indicators.
- 5) Automatic detection of unscheduled water flow. In the event of an unscheduled flow exceeds the user-defined allowable flow, the controller activates the normally open master valve, condemns any future start times, triggers audible (if enabled) and visual alarm indicators.
- 6) Automatic detection of station's upper flow limit. In the event of excessive flow detection, the controller turns off the faulty station, advances the program to the next station, condemns the station from any future watering times, and triggers audible (if enabled) and visual alarm indicators.
- 7) Automatic Detection of station's no-flow condition. When flow is expected and the controller measures a zero flow, the controller turns off the faulty station, advances the program to the next station, condemns the station from any future watering times, and triggers audible (if enabled) and visual alarm indicators.
- 8) Alarms that create a no-watering condition will be bypassed until the alarms are cleared. All non- irrigation programs will continue to operate as scheduled.

12. FLOW CONTROL AND MONITORING CAPABILIITES

The controller has:

- 1) Inputs for connectivity up to two flow sensors.
- 2) Ability to enable flow sensor 1, flow sensor 2, or a combination of flow sensors 1 and 2.
- 3) Configurable flow sensor pipe sizes for standard flow sensors
- 4) Brass: 1.0, 1.25, 1.5, 2.0, 2.5 inch sizes
- 5) PVC: 1.5, 2.0, 3.0, 4.0 inch sizes
- 6) Configurable main line flow limit from 0-5000 GPM defines the maximum allowable flow during scheduled irrigation.
- 7) Configurable unscheduled flow limit from 0-999 GPM defines the maximum amount of flow that will be permitted during unscheduled irrigation periods.
- 8) Configurable station upper flow limits from 0-999 GPM.
- 9) Configurable flow check delay between 1 and 6 minutes (1 minute increments). This delay permits stations to stabilize before limit checks are applied.
- 10) Automatic monitoring and display of measured station flow from 0 to 999 GPM.
- 11) Configurable station flow limits; station flow limits can be configured based on auto learned nominal flow or can also be configured by entering limits manually.
- 12) In LEARN mode, a global percentage adjustment from 5% to 80% is used to automatically factor upper flow limits for all stations once the nominal values have been measured.
- 13) Intelligent upper-limit processing for simultaneous station operation.
- 14) A water usage meter indicates total water used by the controller on a per month basis (12-month period).
- 15) The water usage totalizer function measures the total flow over a period of time. The user may elect to reset the flow total at any time.

13. EVAPOTRANSPIRATION (ET) FEATURES

- 1) Ability to enable or disable ET adjustments on a per program basis.
- 2) The ability to use any one of four different ET sources as the basis for its ET calculations:
 - 3) Historical ET values
 - 4) Manually entered ET value
 - 5) ET measurement device
 - 6) Downloaded ET data from the internet
- 7) The ability to input and store Historical ET values for a 12-month period.
- 8) The controller re-calculates station runtimes prior to the start of irrigation, utilizing the current day's ET value and up to 3 days prior if programs were not executed.
- 9) The ability to store an ET reference value. This value is used during the adjusted station runtime
- 10) ET calculations.

- 11) User may enter a manual ET value, which overrides previously entered or accumulated ET data for 7 days. At the end of the 7-day period, the controller automatically reverts to utilizing Historic, Device, or Internet provided daily ET data.
- 12) Connectivity to an ET measuring device such Weather Center.
- 13) The ability to display the last 14 days of daily ET values.
- 14) Ability to display the current ET percent adjustment for all ET enabled programs.

14. KEY HARDWARE FEATURES

- 1) No battery is required.
- 2) Non-volatile memory to retain the programs and controller setup information during power outages or seasonal shutdowns. This information is maintained indefinitely.
- 3) A real-time clock with non-volatile backup to maintain the current date and time during power outages without the need of batteries.
- 4) Clock maintains time for a minimum of 30 continuous days without power.
- 5) Advanced circuitry to automatically monitor internal voltages and reset on-board microprocessor circuitry during electrical disturbances.
- 6) Automatic electronic fuse, which resets intelligently based upon need – no fuses or circuit breakers to reset or replace.
- 7) When a power outage occurs, and power is restored, the controller resumes its programmed real-time irrigation schedule.
- 8) Output and Master Valve boards are equipped with quick connect terminals for ease of wiring.
- 9) Automatically detects board failures and generates an alarm.

15. Output Modules, Master Valve, Pump Station, and Sensor Inputs

- 1) Each station output module has: 8 stations
- 2) Quick connect terminals: connectivity of up to (2) 14-gauge wires.
- 3) 2 quick connect common terminals capable of connecting up to (4) 14-gauge commons per output module
- 4) Green LED diagnostic indicator when the station is powered on
- 5) Station outputs (black) vs. commons (green) are differentiated via color coded terminal blocks.
- 6) Output modules can be added in the field. The controller will re-configure itself on power up to determine the maximum station count (conventional configuration only). Note: Power must be disconnected during installation.
- 7) Each controller has a master valve/sensor board with connectivity for each of the following:
 - Flow sensor 1
 - Flow sensor 2
 - ET device (e.g. Weather Center)
 - Sensor input capable of connecting to either a Rain, Freeze, Rain/Freeze,

- Moisture, Wind or tipping bucket sensor device (e.g. Weather Center)
- Auxiliary 24 VAC terminal rated at 100 milliamps
- Master Valve quick connect terminal with connectivity of up to (2) 14-gauge wires
- Common quick connect terminal with connectivity of up to (2) 14-gauge wires
- Pump Station quick connect terminal with connectivity of up to (2) 14-gauge wires
- 8) Master Valve type can be configured to either a Normally Open Master Valve or a normally - closed master valve.
- 9) Master Valve control is assigned on a per program basis
- 10) Pump Station control is assigned on a per program basis

16. AVAILABLE OPTIONS

The controller has:

- 1) Controller can be purchased as either a 200 station two-wire or conventional up to 48 station.
- 2) Two-Wire and Conventional configurations are mutually exclusive.
- 3) Ability to connect to a communication card to provide connectivity to Internet-based central control software.
- 4) Ability to interface to a Weather Station for local ET data.
- 5) Ability to connect to a Flow sensor.
- 6) Built-in remote control capability and compatibility with remote control system.
- 7) Connectivity for any one of the following dry contact sensors: rain, freeze, rain/freeze, moisture, or wind sensor devices. The enabling of this device can be performed on a per program basis.
- 8) This feature allows non-irrigation programs to execute independent of this device.
- 9) Availability in a variety of enclosure options: standard painted cold-rolled steel wall mount, stainless steel wall mount, stainless steel security pedestals.

17. MECHANICAL SPECIFICATIONS

- 1) Standard Wall Mount enclosure: 18-gauge stainless steel suitable for either indoor or outdoor environments.
- 2) Dimensions: 11" W x 16" H x 5.625" D (27,9cm W x 40,6cm H x 14,29cm D)
- 3) Pedestal Mount: Heavy-Duty 14-gauge stainless steel Strongbox front entry enclosure.
- 4) Dimensions: 18" W x 36" H x 12" D (45,72cm W x 91,44cm H x 30,48cm D)
- 5) Metered Mount: Heavy-Duty 14-gauge stainless steel Strongbox metered with customer and enclosure sections. 100 amp meter/100 amp load center. 16 position with main 1 phase.
- 6) Dimensions: 32" W x 52" H x 18" D (81,28cm W x 132,08cm H x 45,72cm D)
- 7) Temperature Range:

Operating: +14°F to +140°F (-10°C to +60°C). Storage: -22°F to +149°F (-30°C to +65°C).

18. ELECTRICAL SPECIFICATIONS

- 1) Internal Transformer, Class 2, UL Listed, CSA Certified (or equivalent)
- 2) Input: 120 VAC \pm 10%, 50/60 Hz
- 3) Output: 24 VAC \pm 10%, 50/60 Hz, 50 VA
- 4) Total Maximum Load: 1.5A @ 24 VAC. Output Surge Protection (excluding 2-wire decoder models):6KV common, 1KV normal.
- 5) Conventional Configuration:
Maximum Load Per Station: 0.5A @ 24 VAC @ 77° (25°C)
Maximum Load Per Master Valve: 0.5A @ 24 VAC @ 77°F (25°C)
Maximum Load Per Pump Output: 0.5A @ 24 VAC @ 77°F (25°C)
- 6) Two-Wire Configuration
Drive current to a decoder is 100 to 250 milliamps (depending on the solenoid)
Supports up to 100 decoders on the two-wire path

19. DOCUMENTATION

- 1) User's Manual
- 2) Quick Reference Guide (English and Spanish)
- 3) Installation Guide

20. CERTIFICATION AND WARRANTY

- 1) UL, C-UL, and FCC approved.
- 2) Limited 5-year warranty.
- 3) Installation certification by John Deere Green Tech required.

706-2.8 Electrical

1. All electrical equipment shall be NEMA Type 3, waterproofed for exterior installations.
2. All electrical work shall conform to local codes and ordinances.

706-2.9 Low Voltage Control Wiring

1. Master Valve and valve control wire shall be 14 AWG-UF type for use in accordance with the National Electrical Code for operation at a potential of 600 Volts or less and at a temperature of 75°C or less. Listed by UL or ETL or CSA. Soft drawn bare copper

- conductor meeting the requirements of ASTM specification B-3 or B-8. Polyvinyl chloride insulation, 75°C rated conforming to UL Standards 493 and 83.
2. Flow sensor wire shall be Rain Master EV-CAB-SEN. Refer to **Appendix 4**. 2 - 20 AWG foil shield w/drain, black jacket, two conductors BLK and WHT. Cable shall not exceed 2000 feet in length.
 3. Dry Splice connections shall be 3M™ Direct Bury Splice Kit DBR/Y-6. It includes the 3M "Performance Plus" Electrical Spring Connector and a high impact, UV-resistant polypropylene tube prefilled with moisture-resistant gel.
 4. Control wires shall be black (where two or more controllers are used, the control wires shall be a different color for each controller). Control spare wire shall be red. Common wires shall be white in color. These colors shall be noted on the "Record Drawings" plans.
 5. Master Valve control wires shall be blue. Common wire shall be white with a blue stripe.
 6. Ground wires shall be green in color or bare solid copper and in no case smaller than 6 gauge.

706-2.10 Miscellaneous Equipment

1. Landscape Fabric:
 - 1) Landscape fabric for valve box assemblies shall be 5.0- oz. weight woven polypropylene weed barrier. Landscape fabric shall have a burst strength of 225 PSI, a puncture strength of 60 lbs. and capable of water flow of 12 gallons per minute per square foot.
 - 2) Type: DeWitt Pro 5 Weed Barrier or approved equal.
 - 3) Refer to **Appendix 4**, installation detail 5 and 6.
2. Equipment such as flow sensors, rain sensors, and master valves shall be of the manufacturer, size and type indicated in **Appendices 1 and 2**.

706-3 Execution

706-3.1 Site Conditions

1. Inspections:
 - 1) 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.
 - 2) Verify that irrigation system may be installed in strict accordance with all pertinent codes and regulations, the original design, the referenced standards, and the manufacturer's recommendations.

2. Discrepancies:
 - 1) In the event of discrepancy, immediately notify the City's authorized representative.
 - 2) Do not proceed with installation in areas of discrepancy until all discrepancies have been resolved.

3. Field Measurements:
 - 1) Make all necessary measurements in the field to ensure precise fit of items in accordance with the original design. Contractor shall coordinate the installation of all irrigation materials with all other work.
 - 2) All scaled dimensions are approximate. The Contractor shall check and verify all size dimensions prior to proceeding with work under this section.
 - 3) Exercise extreme care in excavating and working near existing utilities. Contractor must contact Underground Service Alert of Southern California (a.k.a. DigAlert) at least two (2) working days prior to beginning any digging or excavation work. Contractor shall be responsible for damages to utilities, which are caused by his operations or neglect.

4. Layout: Prior to installation, the Contractor shall stake out all controller, solar, master valve, and flow sensor locations. Routing of master valve and flow sensor conduits shall be indicated with white inverted marking paint.

Water Supply: Connections to, or the installation of, the water supply shall be at the locations indicated in **Appendix 2**. Minor changes caused by actual site conditions shall be made at no additional expense to City.

5. Electrical Service:

- 1) Connections to the electrical supply shall be at the locations shown on **Appendix 7**. Minor changes caused by actual site conditions shall be made at no additional expense to City.
- 2) Contractor shall make electrical connections to the irrigation controller. Wiring shall be installed in NEC approved conduit.

706-3.2 Trenching

1. Excavations shall be straight with vertical sides, even grade, and support pipe continuously on bottom of trench.
2. Provide minimum cover of 18 inches on pressure supply lines 2 ½ inches and smaller.
3. Provide minimum cover of 24 inches on pressure supply lines 3 inches and larger.
4. Provide minimum cover of 12 inches for control wires within conduit.
5. Pipes installed in a common trench shall have a 4-inch minimum space between pipes.

706-3.3 Backfilling

1. Backfill material on all lines shall be the same as adjacent soil free of debris, litter, and rocks over 1/2 inches in diameter.
2. Backfill shall be tamped in 4-inch layers under the pipe and uniformly on both sides for the full width of the trench and the full length of the pipe. Backfill materials shall be sufficiently damp to permit thorough compaction, free of voids. Backfill shall be compacted to dry density equal to adjacent undisturbed soil and shall conform to adjacent grades.
3. Flooding in lieu of tamping is not allowed.
4. Under no circumstances shall truck wheels be used to compact backfill.

706-3.4 Piping

1. Piping under existing pavement may be installed by jacking, boring, or hydraulic driving. No hydraulic driving is permitted under asphalt pavement.
2. Cutting or breaking of existing pavement is not permitted.
3. Carefully inspect all pipe and fittings before installation, removing dirt, scale, burrs, and reaming. Install pipe with all markings up for visual inspection and verification.
4. Remove all dented and damaged pipe sections.
5. All lines shall have a minimum clearance of 4 inches from each other and 12 inches from lines of other trades.
6. Parallel lines shall not be installed directly over each other.

7. In solvent welding, use only the specified primer and solvent cement and make all joints in strict accordance with the manufacturer's recommended methods including wiping all excess solvent from each weld. Allow solvent welds at least 15 minutes setup time before moving or handling and 24 hours curing time before filling.
8. PVC pipe shall be installed in a manner, which will provide for expansion and contraction as recommended by the pipe manufacturer.
9. Center load all plastic pipe prior to pressure testing.
10. All threaded plastic-to-plastic connections shall be assembled using Teflon tape or Teflon paste.
11. For plastic-to-metal connections, work the metal connections first. Use a non-hardening pipe dope on all threaded plastic-to-metal connections, except where noted otherwise. All plastic-to-metal connections shall be made with plastic female adapters.

706-3.5 Controller

1. The exact location of the controller shall be approved by the City's authorized representative before installation. The electrical service shall be coordinated with this location.
2. The Irrigation Contractor shall be responsible for the final electrical hook up to the irrigation controller.
3. The irrigation system shall be programmed to operate during the periods of minimal use of the design area.

706-3.6 Controller Wiring

1. Low voltage control wiring shall occupy the same trench and shall be installed along the same route as the pressure supply lines whenever possible.
2. Where more than one wire is placed in a trench, the wiring shall be taped together in a bundle at intervals of 10 feet. Bundle shall be secured to the mainline with tape at intervals of 20 feet.
3. All connections shall be of an approved type and shall occur in a valve box. Provide an 18-inch service loop at each connection.
4. An expansion loop of 12 inches shall be provided at each wire connection and/or directional change, and one of 24 inches shall be provided at each remote control valve.

706-3.7 Flow Sensors/Master Valves

1. Flow sensors and master valves are to be installed in the approximate locations indicated within **Appendix 2**.
2. Flow sensors and master valves shall be installed in shrub areas whenever possible.

3. Flow sensors and master valves to be installed in valve boxes shall be installed one valve per box.
4. Provide valve water ID tags for each piece of equipment.

706-3.8 Valve Boxes

1. Valve boxes shall be installed in shrub areas whenever possible.
2. Each valve box shall be installed on a foundation of 3/4 inch gravel backfill, 3 cubic feet minimum. Valve boxes shall be installed with their tops 1/2 inch above the surface of surrounding finish grade in lawn areas and 2 inches above finish grade in ground cover areas.

706-3.9 Miscellaneous Equipment

1. Install all assemblies specified herein according to the respective detail drawings or specifications, using best standard practices.
2. Install devices such as controllers, master valves and flow sensors as indicated on the drawings and as recommended by the manufacturer.

706-3.10 Testing and Observation

1. Do not allow or cause any of the work of this section to be covered up or enclosed until it has been observed, tested and accepted by the Irrigation, City, and governing agency if applicable.
2. The Contractor shall be solely responsible for notifying the City, and governing agencies, a minimum of 48 hours in advance, where and when the work is ready for testing.
3. When the control system is completed, the Contractor shall perform a controller test of each system in its entirety to determine if the controller is functioning properly in the presence of the City representative.
4. Final inspection will not commence without record drawings as prepared by the Irrigation Contractor.

706-3.10 Completion Cleaning

Clean up shall be made as each portion of the work progresses. Refuse and excess dirt shall be removed from the site, all walks and paving shall be swept, and any damage sustained on the work of others shall be repaired to original conditions.



706-4 Measurement and Payment

Measurement and payment shall be made at the lump sum price as specified in the Bid Sheet under “Irrigation System for City owned Controllers”; “Irrigation System for non-City owned Controllers” and “Flow Sensing and System Components” bid items and shall constitute full compensation for the construction materials, labor and activities for removal and replacement at each location as approved by the Project Manager, complete, in place, including protection after installation, and no additional compensation shall be allowed thereafter.

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APPENDIX 1 – SMART IRRIGATION CONTROLLERS INSTALLATION COST BY UNIT

**SMART IRRIGATION CONTROL SYSTEM PROJECT
 SPECIFICATION NO. 13-14-03
 IN THE CITY OF CALABASAS, CALIFORNIA**

Controller A-1	Saratoga Turf Triangle - 5101 Parkville Road	Materials	Labor
Remove and replace existing wall mount controller. Install new equipment per City standard detail located in Appendix 4, detail 3. 10 valves existing.			
Equipment: SA03-RM2-16/182000IC6/212BCB-ELEC/(10)075-ELEC			
Controller A-2	Grape Arbor Park - 5100 Parkville Road	Materials	Labor
Remove and replace existing wall mount controller. Install new equipment per City standard detail located in Appendix 4, detail 3. Connect to existing ground rod located in maintenance room. 18 valves existing.			
Equipment: SA03-RM2-24			
Controller A-3	Battery Operated - Single Station - Not in project scope of work.	N/A	N/A
Controller B-1	Agoura Road-E. - Malibu Hills Drive	Materials	Labor
Remove and replace existing pedestal mount controller. Demo existing concrete pad, enclosure, and controller. Install new equipment per City standard detail located in Appendix 4, detail 1. 7 valves existing.			
Equipment: SA1-RM2-8/182000IC6/212BCB-ELEC/(10)075-ELEC			
Controller B-2	Summit at Calabasas - Not in project scope of work.	N/A	N/A
Controller B-3	Lost Hills-Malibu Hills Dr., N.E. Corner	Materials	Labor
Remove and replace existing pedestal mount controller and electrical meter enclosure. Coordinate electrical disconnect/reconnect with SCE and City. Demo existing concrete pads, enclosure, controller, and meter pedestal. Protect SCE electrical meter to be installed in new meter pedestal. Install new equipment per City standard detail located in Appendix 4, detail 4. Install splice box with dry splices and extend field valve wiring to new controller enclosure if necessary. 7 valves existing.			
Equipment: SA5-RM2-8/(2)182000IC6/(2)212BCB-ELEC/(20)075-ELEC			
Controller B-4	Calabasas Hills Rd.-Cold Springs, S.W. Corner	Materials	Labor
Remove and replace existing pedestal mount controller. Demo existing concrete pad, enclosure, and controller. Install new equipment per City standard detail located in Appendix 4, detail 1. 15 valves existing.			
Equipment: SA1-RM2-16/182000IC6/212BCB-ELEC/(10)075-ELEC			
Controller B-5	Calabasas Hills Rd. - N.E. Peacock Ridge	Materials	Labor
Remove and replace existing pedestal mount controller. Demo existing concrete pad, enclosure, and controller. Install new equipment per City standard detail located in Appendix 4, detail 1. 7 valves existing.			
Equipment: SA1-RM2-8/182000IC6/212BCB-ELEC/(10)075-ELEC			
Controller B-6	Lost Hills - Cold Springs, N. Calabasas Hills Rd.	Materials	Labor



Remove and replace existing pedestal mount controller and electrical meter enclosure. Coordinate electrical disconnect/reconnect with SCE and City. Demo existing concrete pads, enclosure, controller, and meter pedestal. Protect SCE electrical meter to be installed in new meter pedestal. Install new equipment per City standard detail located in Appendix 4, detail 4. Install splice box with dry splices and extend field valve wiring to new controller enclosure if necessary. 31 valves existing.			
Equipment: SA5-RM2-32/(2)182000IC6/(2)212BCB-ELEC/(20)075-ELEC			
Controller B-7	Lost Hills - S. of Meadow Creek Ln.	Materials	Labor
Remove and replace existing pedestal mount controller. Demo existing concrete pad, enclosure, and controller. Install new equipment per City standard detail located in Appendix 4, detail 1. 22 valves existing.			
Equipment: SA1-RM2-24/182000IC6/212BCB-ELEC/(10)075-ELEC			
Controller B-8	De Anza Park – Tennis - Not in project scope of work.	N/A	N/A
Controller B-9	D’Anza Park - 3701 Lost Hills Rd.	Materials	Labor
Remove and replace existing wall mount controller. Install new equipment per City standard detail located in Appendix 4, detail 3. Grounding installation to be discussed and approved by the City. 23 valves existing.			
Equipment: SA03-RM2-24/182000IC6/212BCB-ELEC/(10)075-ELEC			
Controller C-1	Lost Hills - Las Virgenes, LMD 24	Materials	Labor
Remove and replace existing pedestal mount controller. Demo existing concrete pad, enclosure, and controller. Install new equipment per City standard detail located in Appendix 4, detail 1. 37 valves existing.			
Equipment: SA1-RM2-40/182000IC6/212BCB-ELEC/(10)075-ELEC			
Controller C-2	Las Virgenes - Meadow Creek, LMD 24	Materials	Labor
Remove and replace existing pedestal mount controller. Demo existing concrete pad, enclosure, and controller. Install new equipment per City standard detail located in Appendix 4, detail 1. 5 valves existing.			
Equipment: SA1-RM2-8/182000IC6/212BCB-ELEC/(10)075-ELEC			
Controller C-3	Bark Park - 4232 Las Virgenes Rd.	Materials	Labor
Remove and replace existing pedestal mount controller. Demo existing concrete pad, enclosure, and controller. Install new equipment per City standard detail located in Appendix 4, detail 1. 4 valves existing.			
Equipment: SA1-RM2-8/182000IC6/212BCB-ELEC			
Controller C-4	Las Virgenes Creek Park - Not in project scope of work.	N/A	N/A
Controller D-1	Las Virgenes Median - Clock A, 4955 Las Virgenes Rd. Calabasas Canyon Center	Materials	Labor
Remove and replace existing backboard/controller. Existing metered pedestal mount enclosure to remain in place. Install new equipment per City standard detail located in Appendix 4, detail 8. 5 valves existing.			
Equipment: SA11-RM2-8/182000IC6/212BCB-ELEC/(10)075-ELEC			
Controller D-2	Las Virgenes Median - Clock B, 5224 Las Virgenes Rd. Across from Fire Station	Materials	Labor
Remove and replace existing backboard/controller. Existing metered pedestal mount enclosure to remain in place. Install new equipment per City standard detail located in Appendix 4, detail 8. 11 valves existing.			



Equipment: SA11-RM2-16/182000IC6/212BCB-ELEC/(10)075-ELEC			
Controller D-3	Las Virgenes Pocket Park - 26135 Mureau Rd.	Materials	Labor
Protect in place existing wall mount timer with 6 business park valves. Contractor to remove 6 City valve wires from controller, identified by the City. 6 hot, 1 spare, and 1 common wire will be picked up in planter and run approximately 100' to new pedestal location. Electrical connection will be in place by the City and ready for the contractor to connect to. All splices to be done in 314BCB with 270672 (3M DBR/Y) dry splice connectors. Install new equipment per City standard detail located in Appendix 4, detail 1. 6 valves existing.			
Equipment: SA1-RM2-8/182000IC6/212BCB-ELEC/(10)075-ELEC/(1)314BCB/(8)270672/(660)141BLK/(110)141RED/(110)141WHT			
Controller D-4	Parkmor Battery Operated - Not in project scope of work.	N/A	N/A
Controller D-5	Las Virgenes-Saddleridge	Materials	Labor
Remove and replace existing pedestal mount controller. Demo existing concrete pad, enclosure, and controller. Install new equipment per City standard detail located in Appendix 4, detail 1. 9 valves existing.			
Equipment: SA1-RM2-16/182000IC6/212BCB-ELEC/(10)075-ELEC			
Controller D-6	Thousand Oaks - Center and South Median	Materials	Labor
Install new pedestal mount companion satellite assembly. Electrical meter pedestal and concrete pad will be in place by the City and ready for the contractor to set assembly enclosure. Install new equipment per City standard detail located in RFP Section 210, detail 5. 7 valves existing. Expose existing sleeve under roadway identified by the City. 7 hot, 1 spare, and 1 common wire from center median to south parkway. Trench approximately 35' through existing planter to new metered satellite assembly location in south parkway. All splices to be done in 314BCB with 270672 (3M DBR/Y) dry splice connectors. Remove and replace 7 DC latching solenoids to 24VAC solenoid for existing Superior 950 valves. Estimated quantities for valve boxes, splices, solenoids, and wiring in specifications below, contractor to verify. Remove existing battery operated pedestal enclosure. 6 valves will be added hardwired from Controller D-7 and 4 valves wirelessly from Controllers D-8. 17 total stations to be on this controller.			
Equipment: SA52-RM2-24/(2)182000IC6/(2)212BCB-ELEC/(20)075-ELEC/(1)314BCB/(22)270672/(7)16200/(600)141BLK/(100)141RED/(100)141WHT			
Controller D-7	Thousand Oaks - North Parkway	Materials	Labor
Remove existing battery operated pedestal timer and install splice box for 6 hot, 1 spare, and 1 common. All splices to be done in 314BCB with 270672 (3M DBR/Y) dry splice connectors. Run wires in 1-1/2" electrical conduit through north parkway 420' to existing sleeve location identified by the City. Electrical conduit to have minimum 12" of cover with two 314BCB pull boxes along the run. Electrical sweeps into splice or pull boxes must be used. Run all wires to controller D-6 location utilizing known sleeve locations and existing trench opening for controller D-6. Remove and replace 6 DC latching solenoids to 24VAC solenoid for existing Superior 950 valves. Estimated quantities for valve boxes, splices, solenoids, conduit, and wiring is in specifications below, contractor to verify.			
Equipment: (3)314BCB/(20)270672/(420)150-ELEC/(6)16200/(3120)141BLK/(520)141RED/(520)141WHT			
Controller D-8	Thousand Oaks - Turf Median	Materials	Labor



Install new pedestal mount WRA solar assembly with enclosure 6-8' from existing controller location. Demo existing solar mounted controller enclosure and install splice box. All splices to be done in 314BCB with 270672 (3M DBR/Y) dry splice connectors. Install new equipment per City standard detail located in Appendix 4, detail 1 and 9. Remove and replace 4 DC latching solenoids to 24VAC solenoid for existing Superior 950 valves. 4 valves existing will wirelessly communicate back to Controller D-6.			
Equipment: CA1-WRA-10/SOLAR24-50/182000IC6/212BCB-ELEC/(4)16200/314BCB/ (13)270672/(10)075-ELEC			
Controller D-9	Gates Canyon Park - 25801 Thousand Oaks Rd.	Materials	Labor
Remove and replace existing wall mount controller. Install new equipment per City standard detail located in Appendix 4, detail 3. Contractor to also remove older generations of controllers in this room. Note that new wall mount controller installation to be done at eye level. Grounding installation to be discussed and approved by the City. 27 valves existing.			
Equipment: SA03-RM2-32/182000IC6/212BCB-ELEC/(10)075-ELEC			
Controller E-1	Parkway Calabasas - Ariella Dr.	Materials	Labor
Remove and replace existing pedestal mount controller. Demo existing concrete pad, enclosure, and controller. Install new equipment per City standard detail located in Appendix 4, detail 1. 20 valves existing. Contractor to remove City identified 5 valve wires from adjacent controller and connect to the new system. 25 valves final station count. Contractor to protect in place existing adjacent HOA controller/pedestal.			
Equipment: SA1-RM2-32/182000IC6/212BCB-ELEC/(10)075-ELEC			
Controller E-2	Parkway Calabasas - Palmilla Dr.	Materials	Labor
Install iCentral cellular communication card and antenna. Contractor to protect in place existing pedestal mount controller/enclosure. Install grounding package per City standard detail located in Appendix 4, detail 1. 12 valves existing.			
Equipment: EGI-CELLULAR-KIT/182000IC6/212BCB-ELEC/(10)075-ELEC			
Controller E-3	Parkway Calabasas - Palmilla Dr.	Materials	Labor
Install iCentral cellular communication card, antenna, and controller sub assembly. Contractor to protect in place existing pedestal mount controller/enclosure. Install grounding package per City standard detail located in Appendix 4, detail 1. 2 valves existing.			
Equipment: EGI-CELLULAR-KIT/CSA/182000IC6/212BCB-ELEC/(10)075-ELEC			
Controller E-4	Parkway Calabasas - Camino Portal, N.E. Corner Behind Wall	Materials	Labor
Remove and replace existing backboard/controller. Existing Strong Box front entry enclosure to remain in place. Install new equipment per City standard detail located in Appendix 4, detail 7. 33 valves existing.			
Equipment: SA10-RM2-40/182000IC6/212BCB-ELEC/(10)075-ELEC			
Controller E-5	Parkway Calabasas - Paseo Primario	Materials	Labor
Remove and replace existing pedestal mount controller. Demo existing concrete pad, enclosure, and controller. Install new equipment per City standard detail located in Appendix 4, detail 1. 7 valves existing.			
Equipment: SA1-RM2-8/182000IC6/212BCB-ELEC/(10)075-ELEC			
Controller E-6	Parkway Calabasas - N. of Park Entrada	Materials	Labor



Install iCentral cellular communication card, antenna, and controller sub assembly. Contractor to protect in place existing pedestal mount controller/enclosure. Install grounding package per City standard detail located in Appendix 4, detail 1. 9 valves existing.			
Equipment: EGI-CELLULAR-KIT/CSA/182000IC6/212BCB-ELEC/(10)075-ELEC			
Controller E-7/E-8	Parkway Calabasas - Medians	Materials	Labor
Remove and replace existing pedestal mount controller. Demo existing concrete pad, enclosure, and controller. Install new equipment per City standard detail located in Appendix 4, detail 1. 36 valves existing.			
Equipment: SA1-RM2-40/182000IC6/212BCB-ELEC/(10)075-ELEC			
Controller E-9	Parkway Calabasas - Near LVWD Enclosure	Materials	Labor
Remove and replace existing pedestal mount controller. Demo existing concrete pad, enclosure, and controller. Install new equipment per City standard detail located in Appendix 4, detail 1. 9 valves existing.			
Equipment: SA1-RM2-16/182000IC6/212BCB-ELEC/(10)075-ELEC			
Controller E-10	Parkway Calabasas - S. of Park Granada	Materials	Labor
Remove and replace existing backboard/controller. Existing Strong Box front entry enclosure to remain in place. Install new equipment per City standard detail located in Appendix 4, detail 7. 19 valves existing.			
Equipment: SA10-RM2-24/182000IC6/212BCB-ELEC/(10)075-ELEC			
Controller F-1	Freeway Controller A	Materials	Labor
Remove and replace existing backboard/controller. Existing Strong Box SB-18SS front entry enclosure to remain in place. Ground rod already installed. Connect existing master valve/flow sensor wiring and test. Install new equipment per City standard detail located in Appendix 4, detail 7. 22 valves existing.			
Equipment: SA10-RM2-24			
Controller F-2	Freeway Controller B	Materials	Labor
Remove and replace existing backboard/controller. Existing Strong Box SB-18DSS front entry enclosure to remain in place. Ground rod already installed. Connect existing master valve/flow sensor wiring and test. Install new equipment per City standard detail located in Appendix 4, detail 7. 36 valves existing.			
Equipment: SA10-RM2-40			
Controller F-3	Freeway Controller C	Materials	Labor
Remove and replace existing backboard/controller. Existing Strong Box SB-18DSS front entry enclosure to remain in place. Ground rod already installed. Connect existing master valve/flow sensor wiring and test. Install new equipment per City standard detail located in Appendix 4, detail 7. 13 valves existing.			
Equipment: SA10-RM2-16			
Controller F-4	Parkway Calabasas - Calabasas Rd.	Materials	Labor
Remove and replace existing pedestal mount controller. Demo existing concrete pad, enclosure, and controller. Install new equipment per City standard detail located in Appendix 4, detail 1. 7 valves existing.			
Equipment: SA1-RM2-8/182000IC6/212BCB-ELEC/(10)075-ELEC			
Controller F-5	Calabasas Rd. - Civic Center	Materials	Labor



Remove and replace existing pedestal mount controller. Demo existing concrete pad, enclosure, and controller. Install new equipment per City standard detail located in Appendix 4, detail 1. 5 valves existing.			
Equipment: SA1-RM2-8/182000IC6/212BCB-ELEC/(10)075-ELEC			
Controller F-6	Parkway Calabasas - Sorrento	Materials	Labor
Remove and replace existing backboard/controller. Existing Strong Box SB-18SS front entry enclosure to remain in place. Install new equipment per City standard detail located in Appendix 4, detail 7. 4 valves existing.			
Equipment: SA10-RM2-8/182000IC6/212BCB-ELEC/(10)075-ELEC			
Controller F-7	Parkway Calabasas - Park Granada	Materials	Labor
Remove and replace existing backboard/controller. Existing All Spec AS-18SS front entry enclosure to remain in place. Install new equipment per City standard detail located in Appendix 4, detail 7. 11 valves existing.			
Equipment: SA10-RM2-16(ALLSPEC)/182000IC6/212BCB-ELEC/(10)075-ELEC			
Controller F-8	Civic Center - 100 Civic Center Way	Materials	Labor
Remove and replace existing pedestal mount controller/enclosure. Contractor to anchor new enclosure into existing concrete. Install new equipment per City standard detail located in Appendix 4, detail 1. Grounding installation to be discussed and approved by the City. 23 valves existing.			
Equipment: SA1-RM2-24/182000IC6			
Controller F-9	Park Granada - N. of Parkway Calabasas	Materials	Labor
Remove and replace existing backboard/controller. Existing Strong Box SB-18SS front entry enclosure to remain in place. Install new equipment per City standard detail located in Appendix 4, detail 7. 6 valves existing.			
Equipment: SA10-RM2-8/182000IC6/212BCB-ELEC/(10)075-ELEC			
Controller F-10	Park Capri	Materials	Labor
Remove and replace existing pedestal mount enclosure and two controllers. Demo existing concrete pad, enclosure, and controllers. Install back to back enclosure assembly with City controller on one side and Oak Park Condo controller on the other. Install new equipment per City standard detail located in Appendix 4, detail 2. 6 valves existing.			
Equipment: SA2-RM2-8/182000IC6/212BCB-ELEC/(10)075-ELEC			
Controller F-11	Calabasas Rd. - Commons Way	Materials	Labor
Remove and replace existing backboard/controller. Existing Strong Box SB-18SS front entry enclosure to remain in place. Install new equipment per City standard detail located in Appendix 4, detail 7. 5 valves existing.			
Equipment: SA10-RM2-8/182000IC6/212BCB-ELEC/(10)075-ELEC			
Controller F-12	Park Granada - S. of Park Sorrento	Materials	Labor
Remove and replace existing pedestal mount controller and electrical meter enclosure. Coordinate electrical disconnect/reconnect with SCE and City. Demo existing concrete pads, enclosure, controller, and meter pedestal. Protect SCE electrical meter to be installed in new meter pedestal. Install new equipment per City standard detail located in Appendix 4, detail 4. Install splice box with dry splices and extend field valve wiring to new controller enclosure if necessary. 8 valves existing.			
Equipment: SA5-RM2-8/(2)182000IC6/(2)212BCB-ELEC/(20)075-ELEC			



Controller F-13	Calabasas Rd. - E. of Park Granada	Materials	Labor
Remove and replace existing backboard/controller. Existing Strong Box SB-18SS front entry enclosure to remain in place. Install new equipment per City standard detail located in Appendix 4, detail 7. 16 valves existing.			
Equipment: SA10-RM2-24/182000IC6/212BCB-ELEC/(10)075-ELEC			
Controller F-14	Tennis and Swim Center - SW Pool Storage 23400 Park Sorrento	Materials	Labor
Remove and replace existing wall mount controller. Install new equipment per City standard detail located in Appendix 4, detail 3. Grounding installation to be discussed and approved by the City. 12 valves existing.			
Equipment: SA03-RM2-16/182000IC6/212BCB-ELEC/(10)075-ELEC			
Controller F-15	Tennis and Swim Center - Delivery Entrance 23400 Park Sorrento	Materials	Labor
Remove and replace existing wall mount controller. Install new equipment per City standard detail located in Appendix 4, detail 3. 14 valves existing.			
Equipment: SA03-RM2-16/182000IC6/212BCB-ELEC/(10)075-ELEC			
Controller F-16	Tennis and Swim Center - Tennis Courts 23400 Park Sorrento	Materials	Labor
Remove and replace existing pedestal mount controller. Demo existing concrete pad, enclosure, and controller. Install new equipment per City standard detail located in Appendix 4, detail 1. 30 valves existing.			
Equipment: SA1-RM2-32/182000IC6/212BCB-ELEC/(10)075-ELEC			
Controller F-23-CBA	Park Granada - Park Sorrento	Materials	Labor
Install new pedestal mount WRA solar assembly with enclosure. Demo existing solar mounted controller enclosure. Install new equipment per City standard detail located in Appendix 4, detail 1 and 9. Convert existing remote control valve DC latching solenoids to manufacturer matching 24VAC solenoids (contractor to verify). 6 valves existing.			
Equipment: CA1-WRA-10/SOLAR24-50/182000IC6/212BCB-ELEC/(10)075-ELEC/ (6)16200/(12)270672			
Controller G-1	Highland Park	Materials	Labor
Install new solar assembly with back to back enclosure. Install equipment per City standard detail located in Appendix 4, detail 2 and 9. Remove and replace 12VDC latching solenoids to 24VAC solenoid for existing Rain Bird PEB valves. 3 valves existing.			
Equipment: SA2-RM2-8/182000IC6/212BCB-ELEC/(10)075-ELEC /SOLAR-200/(3)209532-02/(6)270672			
Controller G-2	Creekside Park - Ball Field 3655 Old Topanga Canyon Rd.	Materials	Labor
Remove and replace existing backboard/controller. Existing Strong Box SB-24SS front entry enclosure to remain in place. Install new equipment per City standard detail located in Appendix 4, detail 8. 10 valves existing.			
Equipment: SA11-RM2-16/182000IC6/212BCB-ELEC/(10)075-ELEC			
Controller G-3	Creekside Park - Kinder Garden 3655 Old Topanga Canyon Rd.	Materials	Labor
Remove and replace existing wall mount controller. Install new equipment per City standard detail located in Appendix 4, detail 3. Grounding installation to be discussed and approved by the City. 9 valves existing.			



Equipment: SA03-RM2-16/182000IC6/212BCB-ELEC/(10)075-ELEC			
Controller H-1	Mulholland Highway - Eddingham	Materials	Labor
<p>Install new pedestal mount companion satellite assembly. Electrical meter pedestal and concrete pad will be in place by the City and ready for the contractor to set assembly enclosure. Install new equipment per City standard detail located in RFP Section 210, detail 5. 7 valves existing. Expose existing sleeve under roadway identified by the City. 2 hot, 1 spare, and 1 common wire from north parkway. 3 hot, 1 spare, and 1 common from center median. 2 hot, 1 spare, and 1 common from south parkway. Trench approximately 110' through existing turf and planter to new metered satellite assembly location in south parkway. All splices to be done in 314BCB with 270672 (3M DBR/Y) dry splice connectors. Contractor to run separate common and spare from each valve grouping back to controller. Remove and replace 7 DC latching solenoids to 24VAC solenoid for existing Superior 950 valves. Estimated quantities for valve boxes, splices, solenoids, and wiring in specifications below, contractor to verify. Remove existing battery operated pedestal enclosure east of identified sleeve location. 21 valves will be added wirelessly from existing controllers H-2, H-3, and H-4.</p>			
Equipment: SA52-RM2-32/(2)182000IC6/(2)212BCB-ELEC/(2)314BCB/(23)270672/(7)16200/(990)141BLK/(420)141RED/(420)141WHT/(20)075-ELEC			
Controller H-2	Mulholland Highway - Daguerre	Materials	Labor
<p>Remove existing battery operated pedestal timer and install splice box for 7 hot, 1 spare, and 1 common. All splices to be done in 314BCB with 270672 (3M DBR/Y) dry splice connectors. Run wires in 1-1/2" electrical conduit through center median 255' to controller H-3/H-4 location. Electrical conduit to have minimum 12" of cover with one 314BCB pull box along the run. Electrical sweeps into splice or pull boxes must be used. Remove and replace 7 DC latching solenoids to 24VAC solenoid for existing Superior 950 valves. Estimated quantities for valve boxes, splices, solenoids, conduit, and wiring in specifications below, contractor to verify.</p>			
Equipment: 314BCB/(23)270672/(255)150-ELEC/(7)16200/(1820)141BLK/(260)141RED/ (260)141WHT			
Controller H-3/H-4	Mulholland Highway - Eddingham N/S Turf	Materials	Labor
<p>Install new pedestal mount WRA solar assembly with enclosure in south parkway. Expose existing sleeve under roadway identified by the City to run wire to new equipment location, trench 20' to final assembly location in south parkway. Install new equipment per City standard detail located in Appendix 4, detail 1 and 9. Remove existing two battery operated pedestal enclosures. 14 valves existing plus 7 from controller H-2. All splices to be done in 314BCB with 270672 (3M DBR/Y) dry splice connectors. Remove and replace 14 DC latching solenoids to 24VAC solenoid for existing Superior 950 valves. Contractor to run separate common and spare from each controller grouping back to wireless assembly. Estimated quantities for valve boxes, splices, solenoids, conduit, and wiring is in specifications below, contractor to verify.</p>			
Equipment: CA1-WRA-26/SOLAR24-200/182000IC6/212BCB-ELEC/(10)075-ELEC/ 314BCB/(44)270672/(14)16200/(990)141BLK/(420)141RED/(420)141WHT			
Controller H-5/H-6	Mulholland Highway - Daguerre N/S Turf Planter	Materials	Labor
<p>Install new metered satellite assembly. Electrical connection will be in place by the City and ready for the contractor to connect to. Install new equipment per City standard detail located in Appendix 4, detail 4. Remove existing two battery operated pedestal enclosures. 18 valves existing plus 12 valves from controller H-7. Expose</p>			



existing sleeve under roadway identified by the City. 30 hot, 3 spare, and 3 common wires from median, trench approximately 75' through existing turf and planter to new metered satellite assembly location in south parkway. All splices to be done in 314BCB with 270672 (3M DBR/Y) dry splice connectors. Contractor to run separate common and spare from each controller grouping back to metered assembly. Remove and replace 18 DC latching solenoids to 24VAC solenoid for existing Superior 950 valves. Estimated quantities for valve boxes, splices, solenoids, and wiring is in specifications below, contractor to verify.			
Equipment: SA5-RM2-32/(2)182000IC6/(2)212BCB-ELEC/(20)075-ELEC/314BCB/ (56)270672/(18)16200/(3150)141BLK/(315)141RED/(315)141WHT			
Controller H-7	Mulholland Highway - Center Median	Materials	Labor
Remove existing battery operated pedestal timer and install splice box for 12 hot, 1 spare, and 1 common. All splices to be done in 314BCB with 270672 (3M DBR/Y) dry splice connectors. Run wires in 1-1/2" electrical conduit through center median 475' to controller H-5/H-6 location. Electrical conduit to have minimum 12" of cover with two 314BCB pull boxes along the run. Electrical sweeps into splice or pull boxes must be used. Remove and replace 12 DC latching solenoids to 24VAC solenoid for existing Superior 950 valves. Estimated quantities for valve boxes, splices, solenoids, conduit, and wiring is in specifications below, contractor to verify.			
Equipment: (3)314BCB/(14)270672/(475)150-ELEC/(12)16200/(6000)141BLK/(500)141RED/ (500)141WHT			
Controller H-8	Freedom Park	Materials	Labor
Remove and replace existing pedestal mount controller. Demo existing concrete pad, enclosure, and controller. Install new equipment per City standard detail located in Appendix 4, detail 1. 12 valves existing.			
Equipment: SA1-RM2-16/182000IC6/212BCB-ELEC/(10)075-ELEC			
Controller H-9	Mulholland Highway - Median Battery Operated - Not in project scope of work.	N/A	N/A
Handheld Remote		Materials	Labor
Provide quantity 4 Rain Master Complete Remote sets. Equipment will be a turnover item at the end of the contract.			
Equipment: (4)PROMAX			
Rain Shutoff Sensor Option		Materials	Labor
Provide quantity 4, rain switches with vandalism resistant stainless steel enclosures. To be mounted on selected assemblies at the direction of the City.			
Equipment: (4)RGE			

Appendix 1 Equipment Amount: \$ _____
 (Total Equipment Amount in Figures)

Appendix 1 Labor Amount: \$ _____
 (Total Labor Amount in Figures)



APPENDIX 2 - FLOW SENSING AND SYSTEM COMPONENTS INSTALLATION COST BY UNIT

Controller A-1	Saratoga Turf Triangle - 5101 Parkville Road	Materials	Labor
Add master valve and flow sensing capability to this controller location. Install equipment per City standard details located in Appendix 4, detail 5 and 6. Trench 160' through turf to POC. Run master valve and flow sensor wiring in separate 1" electrical conduits with a minimum 12" of cover. Electrical sweeps into wall mount controller and valve boxes must be used.			
Equipment: FSFV-150B/(2)314PBCBR/(2)ID-MAX-P2-RC009/(4)270672/(175)EV-CAB-SEN/(175)141BLU/(175)141WHTBLU/(320)100-ELEC			
Controller B-1	Agoura Road - E. Malibu Hills Drive	Materials	Labor
Add master valve and flow sensing capability to this controller location. Install equipment per City standard details located in Appendix 4, detail 5 and 6. Water meter 75' from controller in planter. Run master valve and flow sensor wiring in separate 1" electrical conduits with a minimum 12" of cover. Electrical sweeps into pedestal mount controller and valve boxes must be used. Contractor to verify existing sleeve under driveway prior to commencing work.			
Equipment: FSFV-200B/(2)314PBCBR/(2)ID-MAX-P2-RC009/(4)270672/(90)EV-CAB-SEN/(90)141BLU/(90)141WHTBLU/(150)100-ELEC			
Controller B-3	Lost Hills - Malibu Hills Dr., N.E. Corner	Materials	Labor
Add master valve and flow sensing capability to this controller location. Install equipment per City standard details located in Appendix 4, detail 5 and 6. Trench 50' through turf to POC. Run master valve and flow sensor wiring in separate 1" electrical conduits with a minimum 12" of cover. Electrical sweeps into pedestal mount controller and valve boxes must be used.			
Equipment: FSFV-200B/(2)314PBCBR/(2)ID-MAX-P2-RC009/(4)270672/(65)EV-CAB-SEN/(65)141BLU/(65)141WHTBLU/(100)100-ELEC			
Controller B-4	Calabasas Hills Rd. - Cold Springs, S.W. Corner	Materials	Labor
Add master valve and flow sensing capability to this controller location. Install equipment per City standard details located in Appendix 4, detail 5 and 6. Trench 5' through planter to POC. Run master valve and flow sensor wiring in separate 1" electrical conduits with a minimum 12" of cover. Electrical sweeps into pedestal mount controller and valve boxes must be used.			
Equipment: FSFV-200B/(2)314PBCBR/(2)ID-MAX-P2-RC009/(4)270672/(20)EV-CAB-SEN/(20)141BLU/(20)141WHTBLU/(10)100-ELEC			
Controller B-5	Calabasas Hills Rd. - N.E. Mountain Shadow Rd.	Materials	Labor
Add master valve and flow sensing capability to this controller location. Install equipment per City standard details located in Appendix 4, detail 5 and 6. Trench 55' through turf to POC. Run master valve and flow sensor wiring in separate 1" electrical conduits with a minimum 12" of cover. Electrical sweeps into pedestal mount controller and valve boxes must be used.			
Equipment: FSFV-200B/(2)314PBCBR/(2)ID-MAX-P2-RC009/(4)270672/(70)EV-CAB-SEN/(70)141BLU/(70)141WHTBLU/(110)100-ELEC			
Controller B-6	Lost Hills - Cold Springs, N. Calabasas Hills Rd.	Materials	Labor



Add master valve and flow sensing capability to this controller location. Install equipment per City standard details located in Appendix 4, detail 5 and 6. Trench 30' through planter to POC. Run master valve and flow sensor wiring in separate 1" electrical conduits with a minimum 12" of cover. Electrical sweeps into pedestal mount controller and valve boxes must be used.			
Equipment: FSFV-200B/(2)314PBCBR/(2)ID-MAX-P2-RC009/(4)270672/(45)EV-CAB-SEN/(145)141BLU/(145)141WHTBLU/(60)100-ELEC			
Controller B-7	Lost Hills - S. of Meadow Creek Ln.	Materials	Labor
Add master valve and flow sensing capability to this controller location. Install equipment per City standard details located in Appendix 4, detail 5 and 6. Trench 40' through planter to POC. Run master valve and flow sensor wiring in separate 1" electrical conduits with a minimum 12" of cover. Electrical sweeps into pedestal mount controller and valve boxes must be used.			
Equipment: FSFV-200B/(2)314PBCBR/(2)ID-MAX-P2-RC009/(4)270672/(55)EV-CAB-SEN/(55)141BLU/(55)141WHTBLU/(80)100-ELEC			
Controller D-2	Las Virgenes Median - Clock B, 5224 Las Virgenes Rd. Across from Fire Station	Materials	Labor
Add master valve and flow sensing capability to this controller location. Install equipment per City standard details located in Appendix 4, detail 5 and 6. Trench 50' through planter to POC. Run master valve and flow sensor wiring in separate 1" electrical conduits with a minimum 12" of cover. Electrical sweeps into pedestal mount controller and valve boxes must be used.			
Equipment: FSFV-100B/(2)314BCB/(2)ID-MAX-Y2-PW017/(4)270672/(65)EV-CAB-SEN/(65)141BLU/(65)141WHTBLU/(100)100-ELEC			
Controller D-5	Las Virgenes -Saddleridge	Materials	Labor
Add master valve and flow sensing capability to this controller location. Install equipment per City standard details located in Appendix 4, detail 5 and 6. Contractor to verify 4 extra wires going into the median prior to commencing work.			
Equipment: FSFV-150B/(2)314BCB/(2)ID-MAX-Y2-PW017/(4)270672			
Controller E-7/E-8	Parkway Calabasas - Medians	Materials	Labor
Existing master valve and flow sensor installed in median. Contractor to pull flow sensor wire through existing conduit. Master valves wires in place but need to be dry spliced.			
Equipment: (50)EV-CAB-SEN/(2)ID-MAX-P2-RC009/(4)270672			
Controller F-13	Calabasas Rd. - E. of Park Granada	Materials	Labor
Add flow sensing capability to this controller location. Contractor to protect master valve in place, confirm operation, replace valve box, and dry splice valve. Install equipment per City standard details located in Appendix 4, detail 6. Master valve adjacent to existing controller pedestal. Run master valve and flow sensor wiring in separate 1" electrical conduits with a minimum 12" of cover. Electrical sweeps into pedestal mount controller and valve boxes must be used.			
Equipment: FSF-150B/(2)314PBCBR/(2)ID-MAX-P2-RC009/(4)270672/(20)EV-CAB-SEN/(20)141BLU/(20)141WHTBLU/(20)100-ELEC			
Controller F-16	Tennis and Swim Center - Tennis Courts 23400 Park Sorrento	Materials	Labor



Add master valve and flow sensing capability to this controller location. Install equipment per City standard details located in Appendix 4, detail 5 and 6. POC adjacent to controller in planter at filter location. Run master valve and flow sensor wiring in separate 1" electrical conduits with a minimum 12" of cover. Electrical sweeps into pedestal mount controller and valve boxes must be used.			
Equipment: FSFV-200B/(2)314PBCBR/(2)ID-MAX-P2-RC009/(4)270672/(20)EV-CAB-SEN/(20)141BLU/(20)141WHTBLU/(20)100-ELEC			
Controller G-1	Highlands Park	Materials	Labor
Add master valve and flow sensing capability to this controller location. Install equipment per City standard details located in Appendix 4, detail 5 and 6. POC adjacent to existing battery operated valves in planter. Run master valve and flow sensor wiring in separate 1" electrical conduits with a minimum 12" of cover. Electrical sweeps into pedestal mount controller and valve boxes must be used.			
Equipment: FSFV-125B/(2)314BCB/(2)ID-MAX-Y2-PW017/(4)270672/(20)EV-CAB-SEN/(20)141BLU/(20)141WHTBLU/(20)100-ELEC			
iCentral Service Plans (Option)		Materials	Labor
Contractor to provide quantity 47, 5 Years of Standard (Bronze/ZipET) wireless data service plans for Rain Master iCentral Control System.			
Equipment: RM-ISVC-5Y			

Appendix 2 Equipment Amount: \$ _____
 (Total Equipment Amount)

Appendix 2 Labor Amount: \$ _____
 (Total Labor Amount)

Appendix 2 Total Propose Amount: \$ _____
 (Total Propose Amount)

APPENDIX 3 – PRODUCT SUMMARY

GENERAL NOTES:

- 1) Estimated quantities or lengths in **Appendices 1 and 2** are indicated in parenthesis. In the absence of parenthesis product should be assumed at quantity one. Contractor shall verify all quantities needed to complete the scope of work described in **Appendices 1 and 2**.
- 2) Electrical sweeps, couplings, and various electrical fittings or boxes required to complete scope of work described in **Appendices 1 and 2** are not specifically called out. Affected installations: master valve and flow sensing conduits, wiring conduits, grounding conduits, 120VAC controller installations, wireless assembly installations, solar installations, and electrical meter installations. Contractor shall make provisions to provide all parts necessary to complete scope of work as described in **Appendices 1 and 2**. Additional information is provided in **Appendix 4 - INSTALLATION DETAILS**.
- 3) Installation locations are identified in **Appendix 7**. It is the Contractors responsibility to verify requested scope of work in **Appendices 1 and 2**. The City shall not be held liable for minor variations in required specifications. Access to all locations is available to the Contractor or by request from the City.

PART NUMBER	MANUFACTURER/DISTRIBUTOR	DESCRIPTION
SA1-RM2-xx	JOHN DEERE GREEN TECH/ RAIN MASTER/VIT STRONG BOX	SATELLITE ASSEMBLY. Front entry Strong Box SB-18SS enclosure and Rain Master Eagle Plus i-Central controller. Assembled by JDGT, 5 year warranty, and installation certification.
SA2-RM2-xx	JOHN DEERE GREEN TECH/ RAIN MASTER/VIT STRONG BOX	SATELLITE ASSEMBLY. Back to back Strong Box SB-18DSS enclosure and Rain Master Eagle Plus i-Central controller. Assembled by JDGT, 5 year warranty, and installation certification.
SA03-RM2-xx	JOHN DEERE GREEN TECH/ RAIN MASTER	SATELLITE ASSEMBLY. Light duty stainless wall mount Rain Master Eagle Plus i-Central controller. 5 year warranty, and installation certification.
SA5-RM2-xx	JOHN DEERE GREEN TECH/ RAIN MASTER/VIT STRONG BOX	SATELLITE ASSEMBLY. Metered Strong Box MPE-A16-10K pedestal and enclosure with Rain Master Eagle Plus i-Central controller. Assembled by JDGT, 5 year warranty, and installation certification.
SA52-RM2-xx	JOHN DEERE GREEN TECH/ RAIN MASTER/VIT STRONG BOX	SATELLITE ASSEMBLY. Front entry Strong Box SB-1852SS companion enclosure and Rain Master Eagle Plus i-Central controller. Assembled by JDGT, 5 year warranty, and installation certification.
SA10-RM2-xx	JOHN DEERE GREEN TECH/ RAIN MASTER/VIT STRONG BOX	SATELLITE ASSEMBLY. Backboard for Strong Box SB-18SS enclosure and Rain Master Eagle Plus i-Central controller. Assembled by JDGT, 5 year warranty, and installation certification.

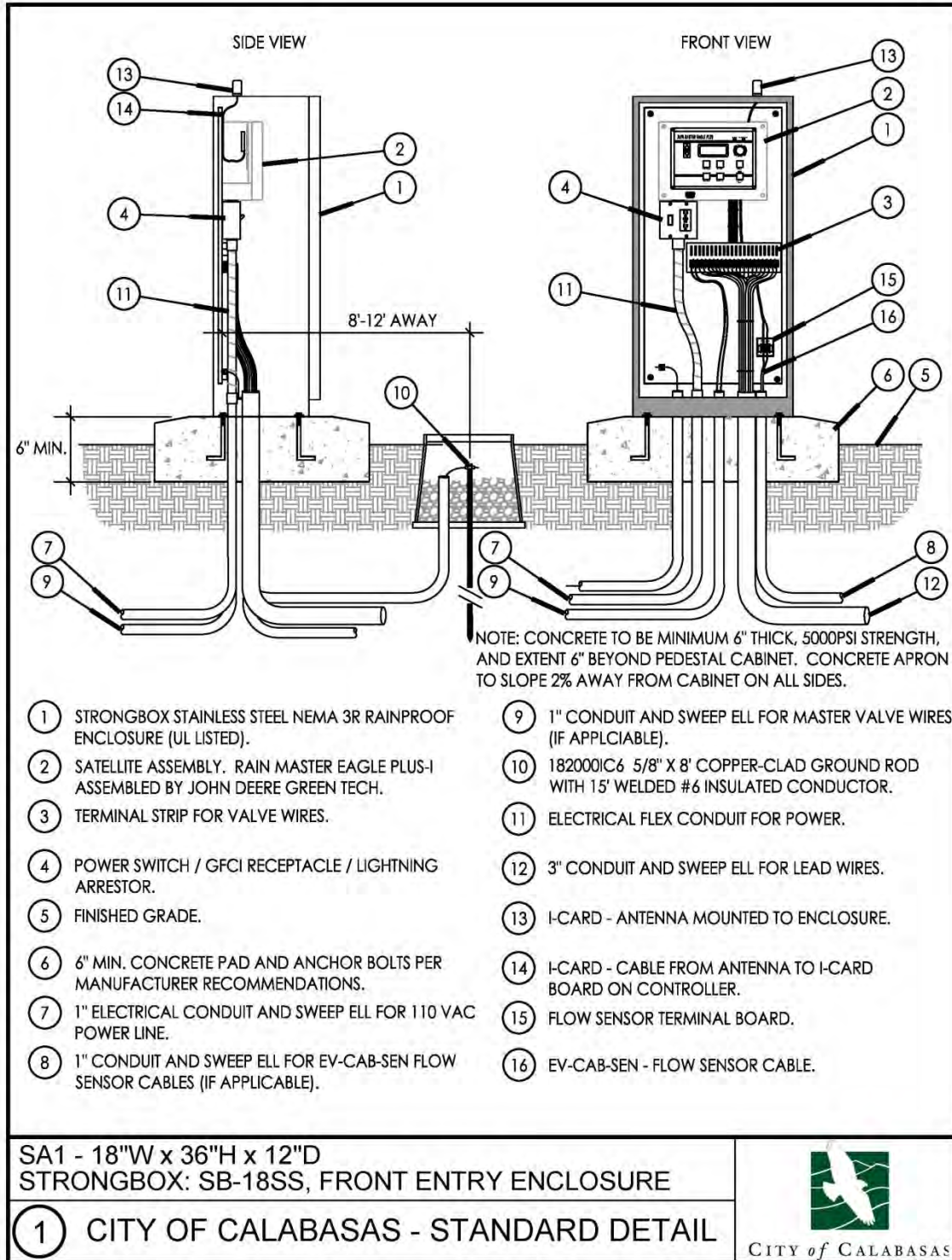
SA11-RM2-xx	JOHN DEERE GREEN TECH/ RAIN MASTER/VIT STRONG BOX	SATELLITE ASSEMBLY. Backboard for Strong Box SB-24SS enclosure and Rain Master Eagle Plus i-Central controller. Assembled by JDGT, 5 year warranty, and installation certification.
CA1-WRA-xx	JOHN DEERE GREEN TECH/ VIT STRONG BOX	WIRELESS CONTROLLER ASSEMBLY. Front entry Strong Box SB-18SS enclosure with wireless relay components, radios, and antennas. 900 MHz transmission system, consists of a transmitter (Tx) and receiver (Rx). Assembled by JDGT, 5 year warranty, and installation certification.
SOLAR24-50	JOHN DEERE GREEN TECH	24V 50 WATT SOLAR ASSEMBLY. Consists of solar panel, mount, battery, inverter, charge controller, digital meter, and circuit breakers. Pre-wired in JDGT assembly, 5 year warranty, and installation certification.
SOLAR24-200	JOHN DEERE GREEN TECH	24V 200 WATT SOLAR ASSEMBLY. Consists of solar panels, mount, batteries, inverter, charge controller, digital meter, and circuit breakers. Pre-wired in JDGT assembly, 5 year warranty, and installation certification.
SOLAR-200	JOHN DEERE GREEN TECH	120V 200 WATT SOLAR ASSEMBLY. Consists of solar panels, mount, batteries, inverter, charge controller, digital meter, and circuit breakers. Pre-wired in JDGT assembly, 5 year warranty, and installation certification.
EGI-CELLULAR-KIT	RAIN MASTER	iCentral Cellular Communication Card for Rain Master Eagle controllers. Includes: LP Antenna , Cables, Hardware, & Two-Year Limited Warranty.
CSA	VIT STRONG BOX	36 STATION CONTROLLER SUBASSEMBLY. Includes 120 volt, 15 amp, ground fault protected duplex box with receptacle and locking switch: flexible conduit and conduit; and terminal strips with placards.
182000IC6	PAIGE ELECTRIC	5/8" x 8' Ground Rod w/ 15' of 6 AWG Green Wire
212-BCB-ELEC	NDS	PRO SERIES VALVE BOX. 10" Round Box, Round Overlapping Bolt-Down Cover – Electrical.
314BCB	NDS	PRO SERIES PLUS VALVE BOX. 14"x19" Corrugated Box, Overlapping Bolt-Down Cover-Irrigation.
314PBCBR	NDS	PRO SERIES PLUS VALVE BOX. 14"x19" Corrugated Box, Overlapping Bolt-Down Cover-Reclaimed Water.
FSFV-100B	JOHN DEERE GREEN TECH/ SUPERIOR CONTROLS/ RAIN MASTER	MASTER VALVE AND FLOW SENSING ASSEMBLY. 1" Superior 3100/3100RWG normally open master valve and 1" Rain Master brass flow sensor. 5 year warranty.
FSFV-125B	JOHN DEERE GREEN TECH/ SUPERIOR CONTROLS/ RAIN MASTER	MASTER VALVE AND FLOW SENSING ASSEMBLY. 1-1/4" Superior 3100/3100RWG normally open master valve and 1-1/4" Rain Master brass flow sensor. 5 year warranty.
FSFV-150B	JOHN DEERE GREEN TECH/ SUPERIOR CONTROLS/ RAIN MASTER	MASTER VALVE AND FLOW SENSING ASSEMBLY. 1-1/2" Superior 3100/3100RWG normally open master valve and 1-1/2" Rain Master brass flow sensor. 5 year warranty.
FSFV-200B	JOHN DEERE GREEN TECH/ SUPERIOR CONTROLS/ RAIN MASTER	MASTER VALVE AND FLOW SENSING ASSEMBLY. 2" Superior 3100/3100RWG normally open master valve and 2" Rain Master brass flow sensor. 5 year warranty.
FSF-150B	JOHN DEERE GREEN TECH/ RAIN MASTER	FLOW SENSING ASSEMBLY. 1-1/2" Rain Master brass flow sensor. 5 year warranty.
EV-CAB-SEN	RAIN MASTER	FLOW SENSING CABLE. 2 - 20 AWG foil shield w/drain, black jacket, two conductor BLK and WHT.



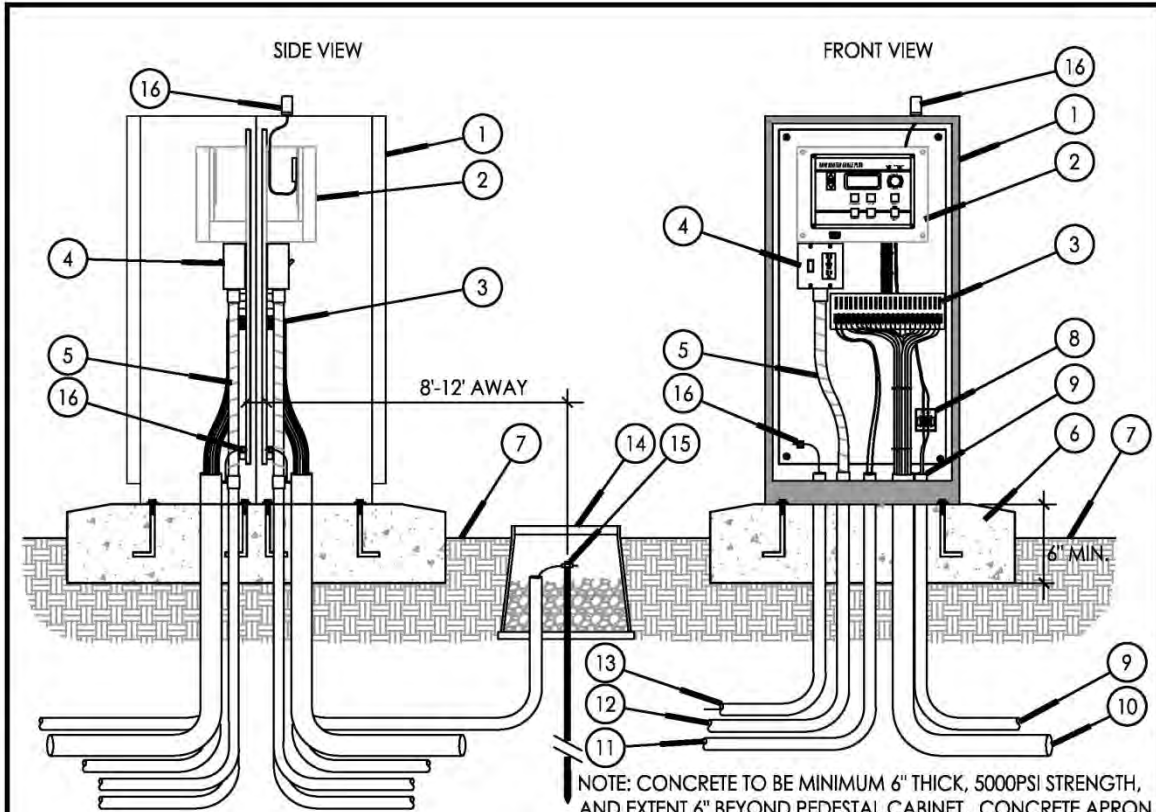
SMART IRRIGATION CONTROL SYSTEM PROJECT
 Technical Specification NO. 13-14-03

16200	SUPERIOR CONTROLS	800 and 950 Series 24V Solenoid Assembly.
209532-02	RAIN BIRD	PEB/EFB/PGA Solenoid Assembly.
270672	PAIGE ELECTRIC	3M™ DBR/Y-6 Direct Bury Splice Kit.
ID-MAX-Y2-PW017	T. CHRISTY	ID Tag Maxi/Size: 3" x 4"/Yellow Potable Water - Do Not Drink/ 2 Sided/ Bilingual
ID-MAX-P2-RC009	T. CHRISTY	ID Tag Maxi/Size: 3" x 4"/Purple Recycled/Reclaimed Water/ 2 Sided/ Bilingual
141BLK	PAIGE ELECTRIC	14 AWG-UF, Irrigation Wire, Black.
141RED	PAIGE ELECTRIC	14 AWG-UF, Irrigation Wire, Red.
141WHT	PAIGE ELECTRIC	14 AWG-UF, Irrigation Wire, White.
141BLU	PAIGE ELECTRIC	14 AWG-UF, Irrigation Wire, Blue.
141WHTBLU	PAIGE ELECTRIC	14 AWG-UF, Irrigation Wire, White with Blue Stripe.
PROMAX	RAIN MASTER	Rain Master Complete Remote set.
RGE	VIT STRONG BOX/HUNTER	Rain switch with vandalism resistant stainless steel enclosure.
RM-ISVC-5Y	RAIN MASTER	5 Years of Standard (Bronze/ZipET) wireless data service plans for Rain Master iCentral Control System.
075-ELEC	MISC	PIPE IPS PVC UL ¾" CONDUIT
100-ELEC	MISC	PIPE IPS PVC UL 1 CONDUIT
150-ELEC	MISC	PIPE IPS PVC UL 1-1/2" CONDUIT

APPENDIX 4 – INSTALLATION DETAILS





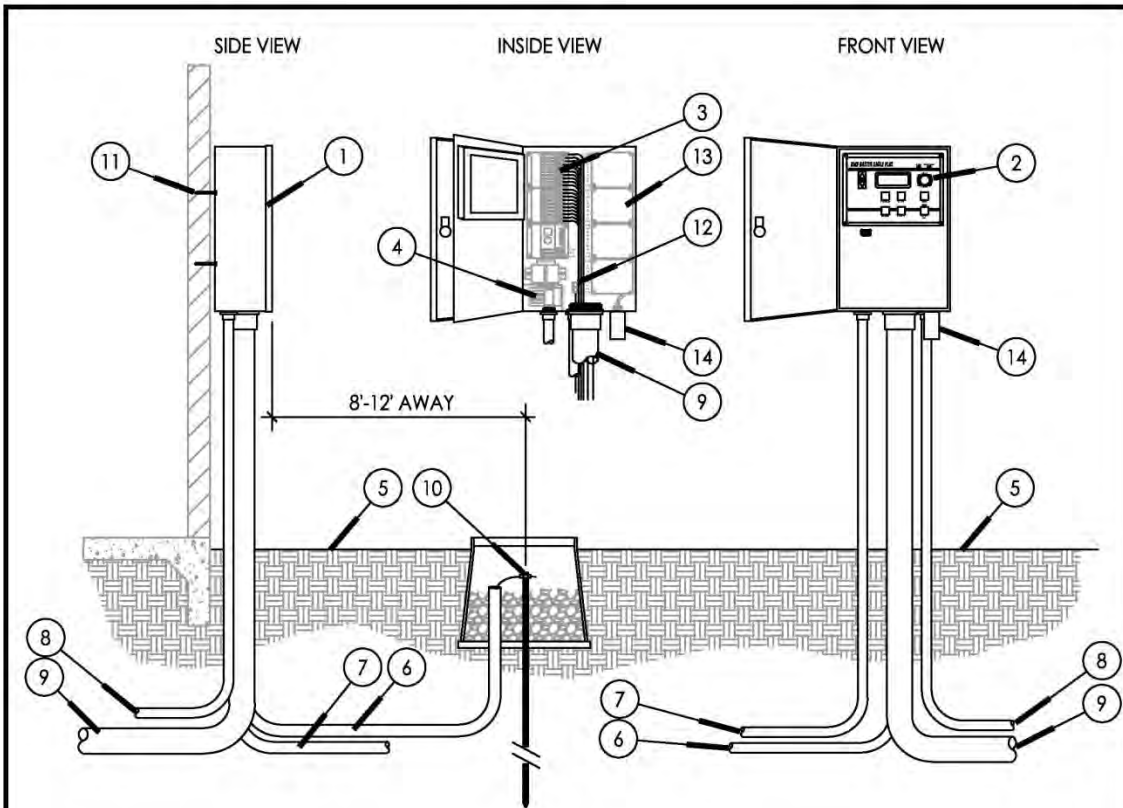


NOTE: CONCRETE TO BE MINIMUM 6" THICK, 5000PSI STRENGTH, AND EXTENT 6" BEYOND PEDESTAL CABINET. CONCRETE APRON TO SLOPE 2% AWAY FROM CABINET ON ALL SIDES.

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| <p>① STRONGBOX STAINLESS STEEL NEMA 3R RAINPROOF ENCLOSURE (UL LISTED).</p> <p>② SATELLITE ASSEMBLY. RAIN MASTER EAGLE PLUS-I ASSEMBLED BY JOHN DEERE GREEN TECH.</p> <p>③ TERMINAL STRIP FOR VALVE WIRES.</p> <p>④ POWER SWITCH / GFCI RECEPTACLE / LIGHTNING ARRESTOR.</p> <p>⑤ ELECTRICAL FLEX CONDUIT FOR POWER.</p> <p>⑥ 6" MIN THICK, CONCRETE PAD WITH ANCHOR BOLTS PER MANUFACTURER RECOMMENDATIONS.</p> <p>⑦ FINISHED GRADE.</p> <p>⑧ FLOW SENSOR TERMINAL BOARD.</p> | <p>⑨ 1" CONDUIT AND SWEEP ELL WITH EV-CAB-SEN FLOW SENSOR CABLE (IF APPLICABLE).</p> <p>⑩ 3" CONDUIT AND SWEEP ELL FOR LEAD WIRES.</p> <p>⑪ 1" CONDUIT AND SWEEP ELL FOR MASTER VALVE WIRES (IF APPLICABLE).</p> <p>⑫ 1" CONDUIT AND SWEEP ELL FOR 110 VAC POWER LINE.</p> <p>⑬ 3/4" CONDUIT AND SWEEP ELL FOR GROUND WIRE.</p> <p>⑭ 10" ROUND VALVE BOX AROUND GROUND ROD. FILL WITH 3/4" CRUSHED ROCK.</p> <p>⑮ 182000IC6 5/8" X 8' COPPER-CLAD GROUND ROD WITH 15' WELDED #6 INSULATED CONDUCTOR.</p> <p>⑯ I-CARD - ANTENNA MOUNTED TO ENCLOSURE.</p> |
|--|--|

SA2 - STRONGBOX: SB-18DSS (18"W x 36"H x 24"D)
 FRONT & REAR ENTRY ENCLOSURE - CONCRETE PAD

② CITY OF CALABASAS - STANDARD DETAIL

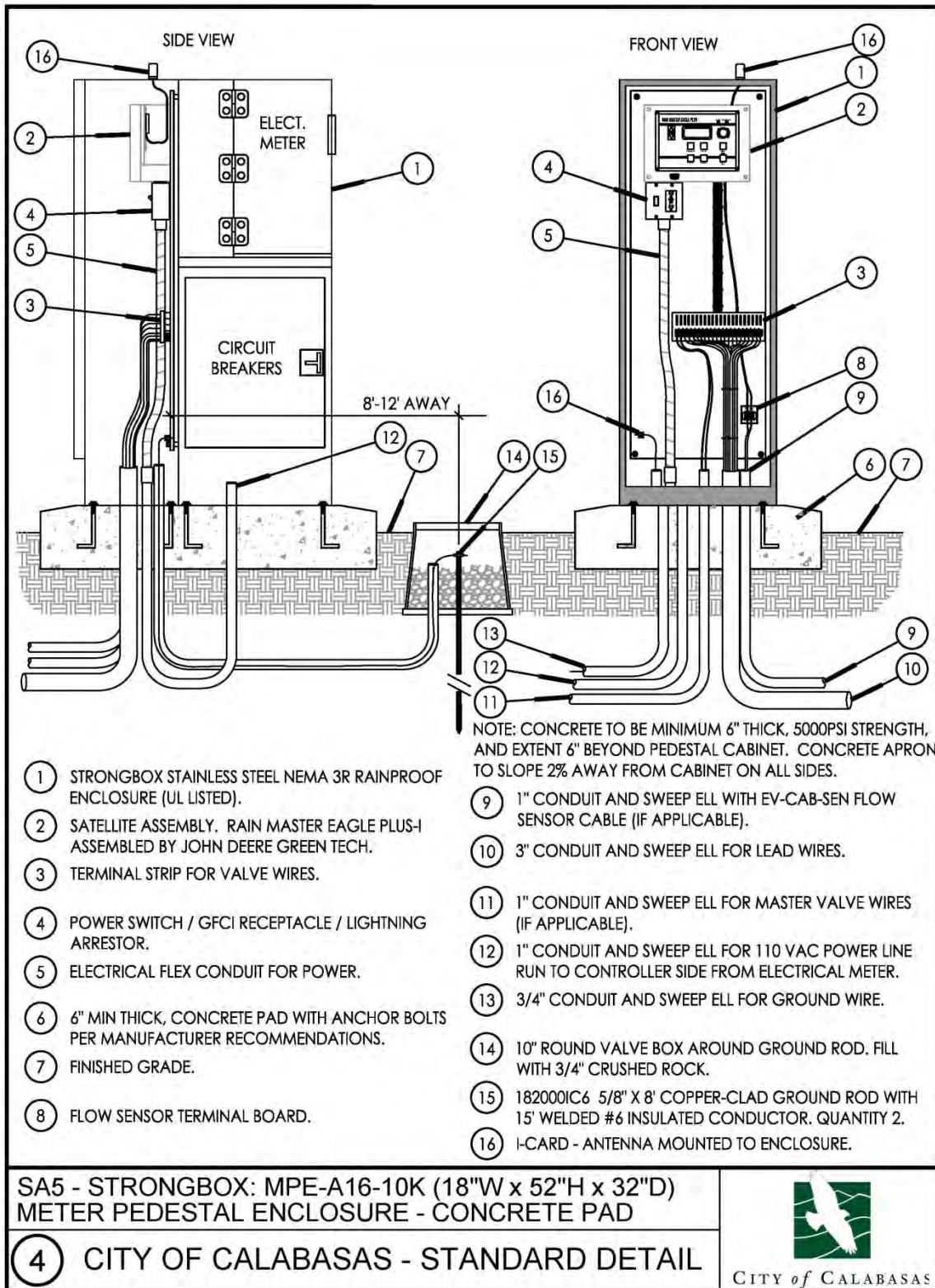


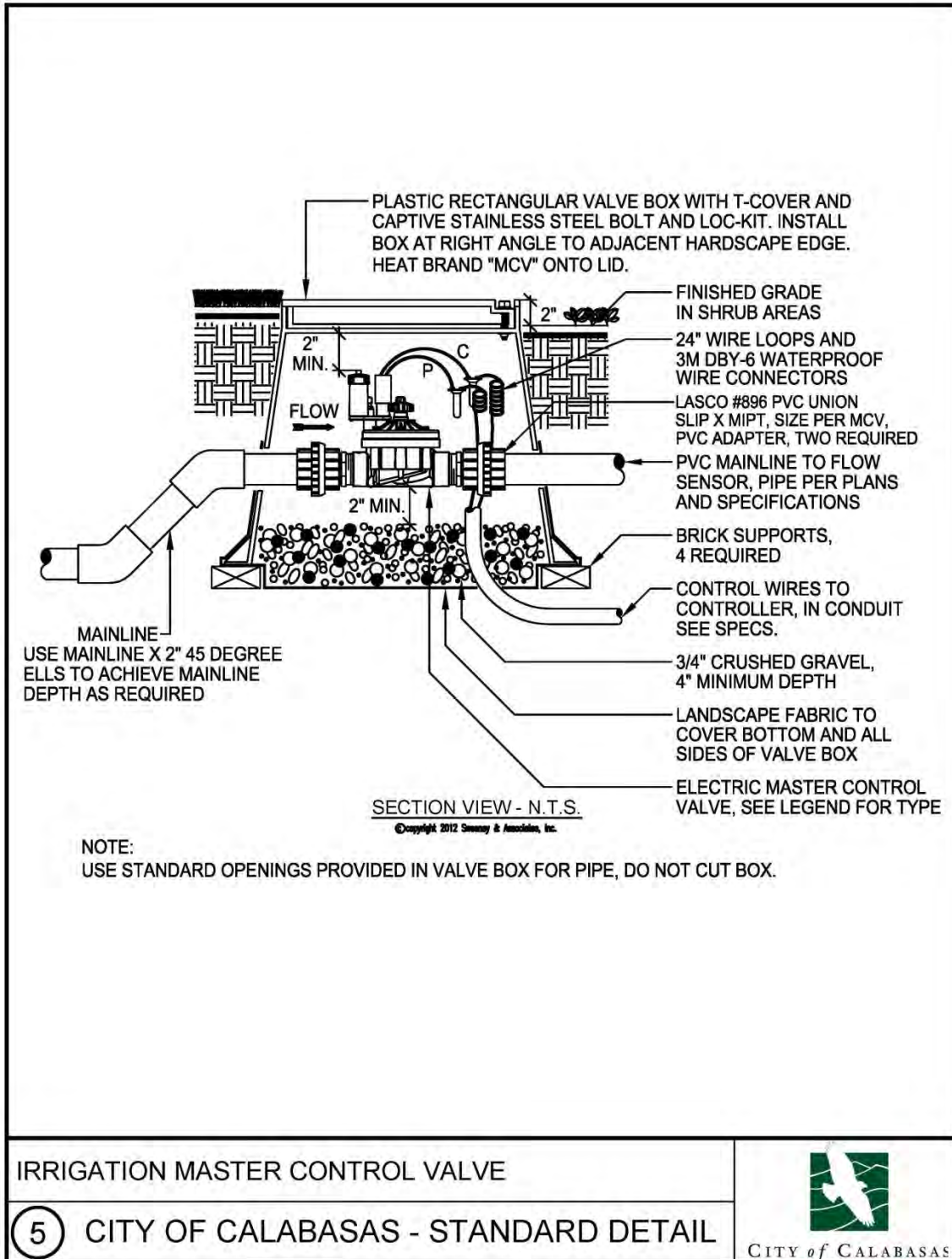
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|---|--|
| ① RAINMASTER STAINLESS STEEL RAINPROOF ENCLOSURE. | ⑨ 2" OR 3" CONDUIT AND SWEEP ELL FOR LEAD WIRES. |
| ② SATELLITE ASSEMBLY. RAIN MASTER EAGLE PLUS-I CONTROLLER BY JDGT. 5 YEAR WARRANTY. | ⑩ 182000IC6 5/8" X 8' COPPER-CLAD GROUND ROD WITH 15' WELDED #6 INSULATED CONDUCTOR. |
| ③ TERMINAL STRIP FOR VALVE WIRES. | ⑪ MOUNT CONTROLLER TO WALL PER MANUFACTURERS SPECIFICATIONS. |
| ④ WIRING TERMINAL BLOCK FOR 110 VAC POWER CONNECTION. | ⑫ GROUNDING TERMINAL. |
| ⑤ FINISHED GRADE. | ⑬ EXPANDABLE MODULAR BOARD LOCATIONS. |
| ⑥ 3/4" CONDUIT AND SWEEP ELL FOR #6 GROUNDING WIRE RUN TO GROUND ROD. | ⑭ I-CARD - ANTENNA MOUNTED TO ENCLOSURE. |
| ⑦ 3/4" ELECTRICAL CONDUIT AND SWEEP ELL FOR 110 VAC POWER LINE. | |
| ⑧ 1" CONDUIT AND SWEEP ELL FOR EV-CAB-SEN FLOW SENSOR CABLES (IF APPLICABLE). | |

SA03 - 11"W x 16"H x 6"D, RAINMASTER EAGLE PLUS-I WALL MOUNT STAINLESS STEEL BOX

③ CITY OF CALABASAS - STANDARD DETAIL

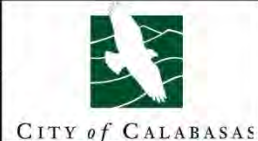




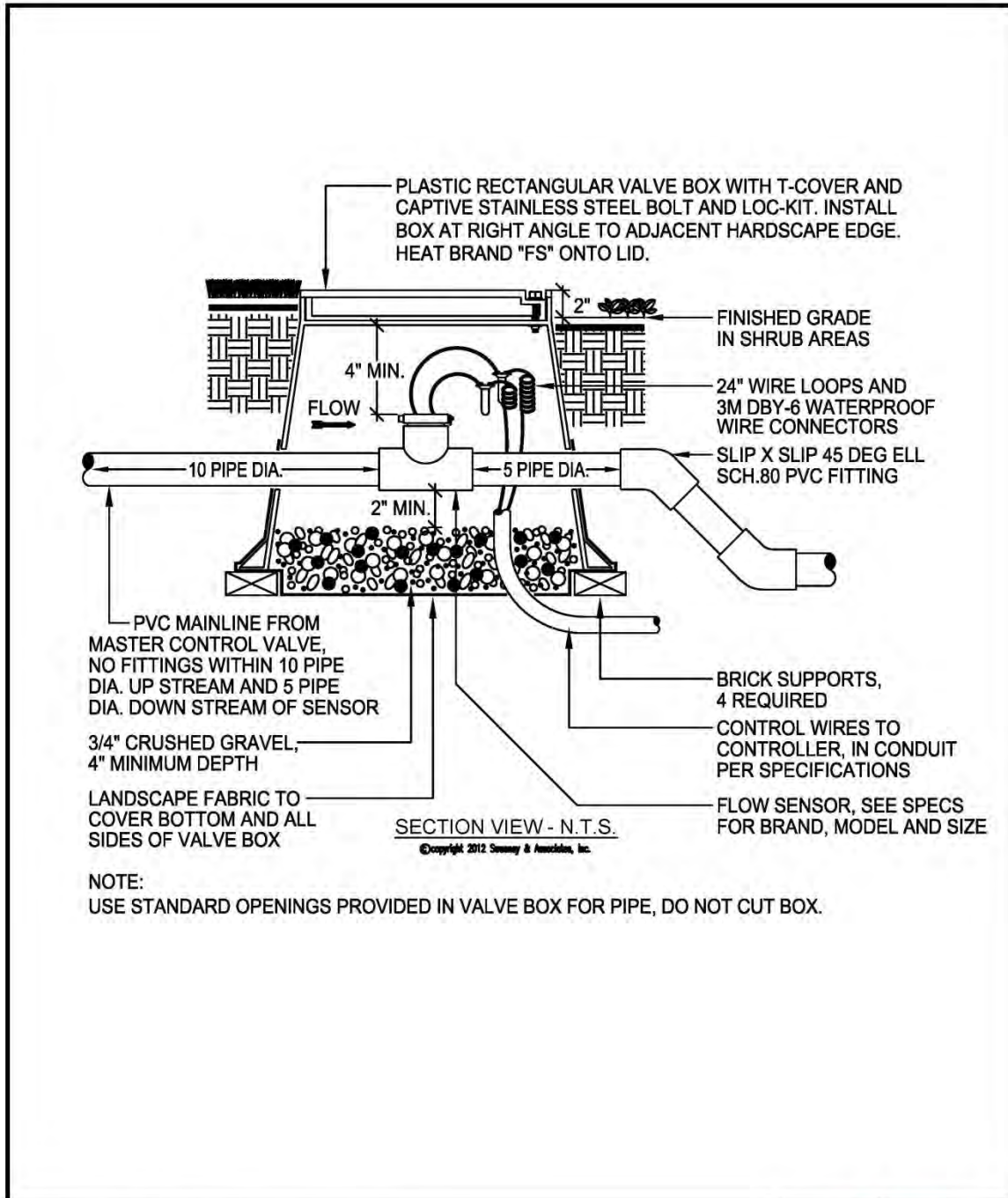


IRRIGATION MASTER CONTROL VALVE

5 CITY OF CALABASAS - STANDARD DETAIL



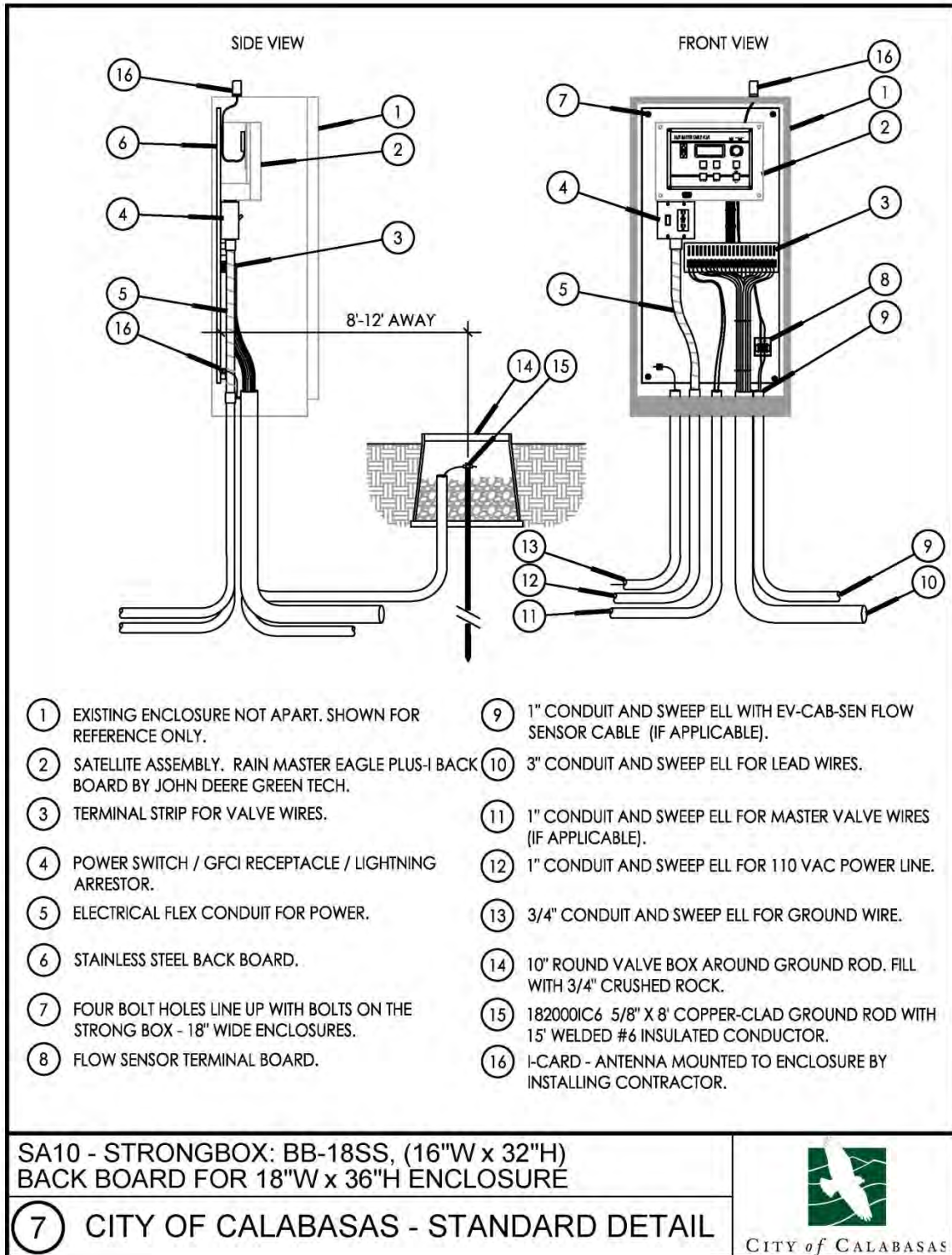




NOTE:
 USE STANDARD OPENINGS PROVIDED IN VALVE BOX FOR PIPE, DO NOT CUT BOX.

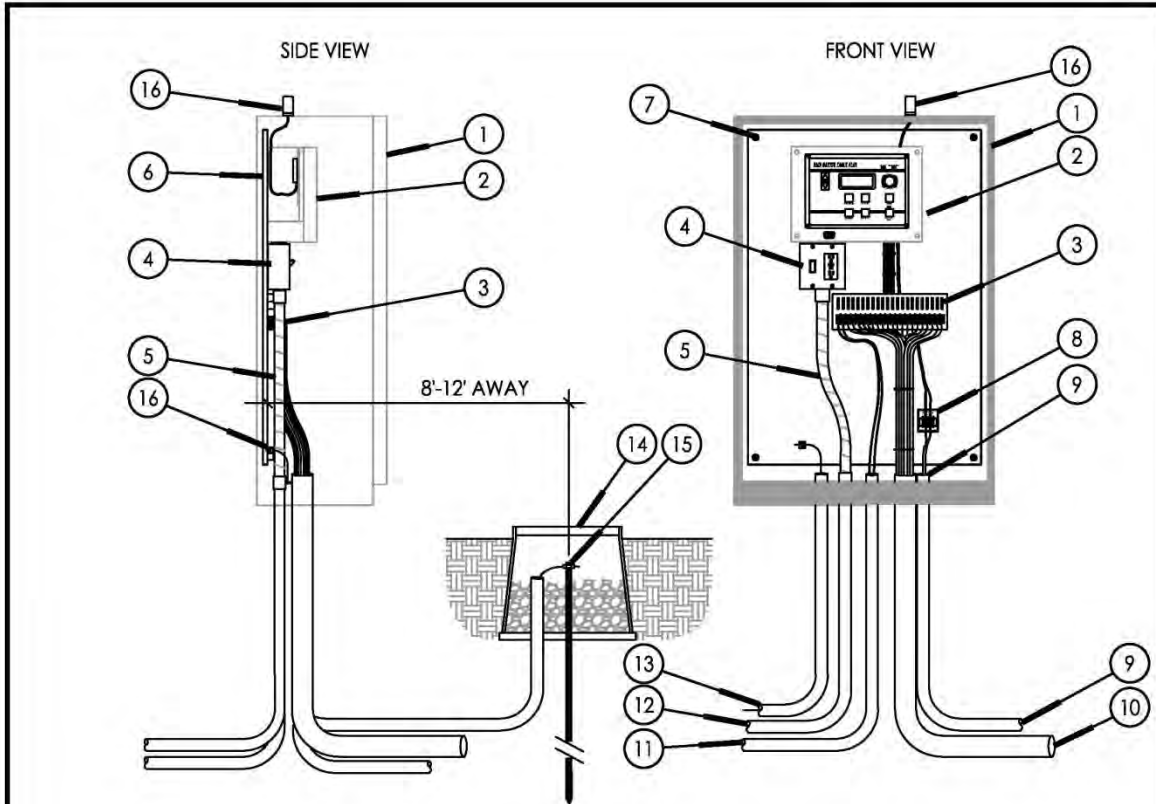
IRRIGATION FLOW SENSOR	
6 CITY OF CALABASAS - STANDARD DETAIL	

CITY of CALABASAS



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|---|---|
| <p>① EXISTING ENCLOSURE NOT APART. SHOWN FOR REFERENCE ONLY.</p> <p>② SATELLITE ASSEMBLY. RAIN MASTER EAGLE PLUS-I BACK BOARD BY JOHN DEERE GREEN TECH.</p> <p>③ TERMINAL STRIP FOR VALVE WIRES.</p> <p>④ POWER SWITCH / GFCI RECEPTACLE / LIGHTNING ARRESTOR.</p> <p>⑤ ELECTRICAL FLEX CONDUIT FOR POWER.</p> <p>⑥ STAINLESS STEEL BACK BOARD.</p> <p>⑦ FOUR BOLT HOLES LINE UP WITH BOLTS ON THE STRONG BOX - 18" WIDE ENCLOSURES.</p> <p>⑧ FLOW SENSOR TERMINAL BOARD.</p> | <p>⑨ 1" CONDUIT AND SWEEP ELL WITH EV-CAB-SEN FLOW SENSOR CABLE (IF APPLICABLE).</p> <p>⑩ 3" CONDUIT AND SWEEP ELL FOR LEAD WIRES.</p> <p>⑪ 1" CONDUIT AND SWEEP ELL FOR MASTER VALVE WIRES (IF APPLICABLE).</p> <p>⑫ 1" CONDUIT AND SWEEP ELL FOR 110 VAC POWER LINE.</p> <p>⑬ 3/4" CONDUIT AND SWEEP ELL FOR GROUND WIRE.</p> <p>⑭ 10" ROUND VALVE BOX AROUND GROUND ROD. FILL WITH 3/4" CRUSHED ROCK.</p> <p>⑮ 182000IC6 5/8" X 8' COPPER-CLAD GROUND ROD WITH 15' WELDED #6 INSULATED CONDUCTOR.</p> <p>⑯ I-CARD - ANTENNA MOUNTED TO ENCLOSURE BY INSTALLING CONTRACTOR.</p> |
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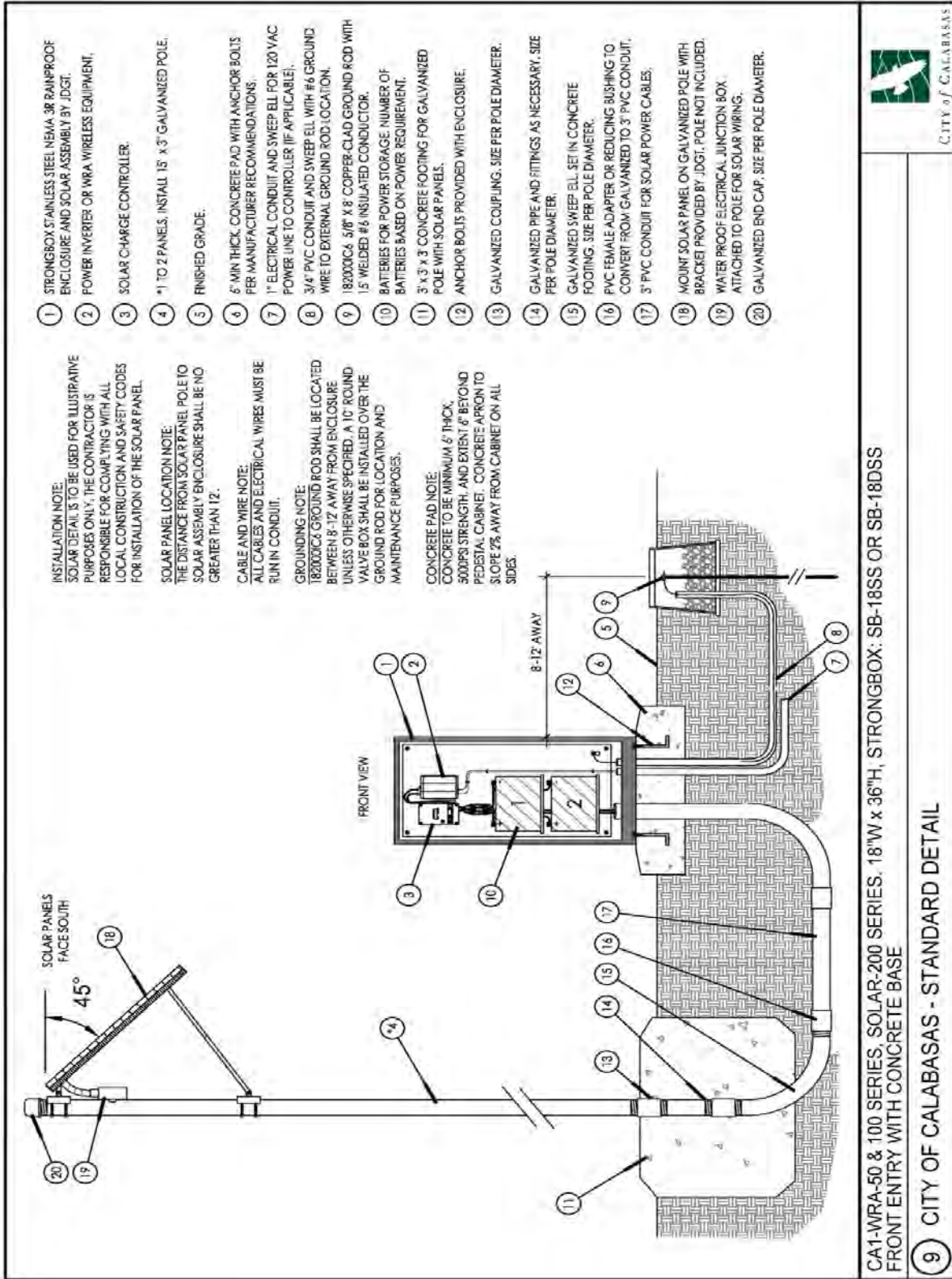


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| <ul style="list-style-type: none"> ① EXISTING ENCLOSURE NOT APART, SHOWN FOR REFERENCE ONLY. ② SATELLITE ASSEMBLY. RAIN MASTER EAGLE PLUS-I BACK BOARD BY JOHN DEERE GREEN TECH. ③ TERMINAL STRIP FOR VALVE WIRES. ④ POWER SWITCH / GFCI RECEPTACLE / LIGHTNING ARRESTOR. ⑤ ELECTRICAL FLEX CONDUIT FOR POWER. ⑥ STAINLESS STEEL BACK BOARD. ⑦ FOUR BOLT HOLES LINE UP WITH BOLTS ON THE STRONG BOX - 24" WIDE ENCLOSURES. ⑧ FLOW SENSOR TERMINAL BOARD. | <ul style="list-style-type: none"> ⑨ 1" CONDUIT AND SWEEP ELL WITH EV-CAB-SEN FLOW SENSOR CABLE (IF APPLICABLE). ⑩ 3" CONDUIT AND SWEEP ELL FOR LEAD WIRES. ⑪ 1" CONDUIT AND SWEEP ELL FOR MASTER VALVE WIRES (IF APPLICABLE). ⑫ 1" CONDUIT AND SWEEP ELL FOR 110 VAC POWER LINE. ⑬ 3/4" CONDUIT AND SWEEP ELL FOR GROUND WIRE. ⑭ 10" ROUND VALVE BOX AROUND GROUND ROD. FILL WITH 3/4" CRUSHED ROCK. ⑮ 182000IC6 5/8" X 8' COPPER-CLAD GROUND ROD WITH 15' WELDED #6 INSULATED CONDUCTOR. ⑯ I-CARD - ANTENNA MOUNTED TO ENCLOSURE BY INSTALLING CONTRACTOR. |
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SA11 - STRONGBOX: BB-24SS, (22"W x 32"H)
 BACK BOARD FOR 24"W x 36"H ENCLOSURE

⑧ CITY OF CALABASAS - STANDARD DETAIL





CA11-WRA-50 & 100 SERIES, SOLAR-200 SERIES, 18"W x 36"H, STRONGBOX: SB-18SS OR SB-18DSS
FRONT ENTRY WITH CONCRETE BASE

9 CITY OF CALABASAS - STANDARD DETAIL



Methods used to Estimate With- and Without-Project Conditions

The annual expected benefits of water quality and other expected benefits are summarized in Table 7.x.6 of Appendix x.2. For this analysis, the water quality improvements, reduction in water quality degradation, and recreation enhancement benefits were not monetized; ecosystem restoration for both Project components was not monetized. The avoided power cost was the only benefit that could be monetized.

III. Citywide Smart Irrigation Control System and Recycled Water Improvements

Water Quality Benefits

This Project will provide a water quality benefit. This benefit is described in detail below and summarized in Table 8.7.

Reduction in Pollutant Discharge

This Project will reduce the amount of surface pollutants due to reduced runoff from 15% of City parks, medians and parkways, totaling approximately 950,000 square feet of surface area. The Project will prevent bacteria, nutrients and metals from contaminating nearby water bodies through dry weather run-off. The Project will prevent 57 AFY of nutrient rich runoff from flowing into the Las Virgenes Creek, Malibu Creek, Dry Canyon Creek, McCoy Creek, Santa Monica Bay, and the Los Angeles River.

Table 8.7: Benefits Summary

Type of Benefit	Assessment Level	Beneficiaries
Reduction in pollutant discharge	Physical Quantification	Local /Regional / Statewide

Other Expected Benefits

This Project will provide other expected benefits, summarized in Table 8.8.

Recreation Benefits

This Project will prevent the over-watering of city parks and parkways making irrigation consistent with weather data. More than 20 acres of landscaped sub-areas will benefit from the Project.

Power Cost Savings

Currently, the cost of electricity to operate city-owned irrigation system is approximately \$6,800 per year. By implementing the smart irrigation control system there will be about a 25% reduction in electricity usage; assuming an electricity rate of \$0.19/KWH, this equates to \$1,700 in annual power cost savings.

Table 8.8: Benefits Summary

Type of Benefit	Assessment Level	Beneficiaries
Recreation benefits (due to efficient irrigation)	Physical Quantification	Local and Regional
Power Cost Savings	Monetized	Local and Regional

Distribution of Project Benefits and Identification of Beneficiaries

The following table summarizes the Project’s beneficiaries. This Project would benefit visitors of the local parks due to the appropriate irrigation of more than 20 acres of recreational space, recreational users of the local creeks and Santa Monica Bay due to reduced runoff pollution.

Table 8.9: Project Beneficiaries Summary

Local	Regional	Statewide
Visitors to local parks	Recreational users of Santa Monica Bay	NA

Project Benefits Timeline Description

The Project benefits will be received beginning in 2011.

Uncertainty of Benefits

There is uncertainty associated with the non-monetized recreational benefits; however, these benefits are likely to increase the net benefits relative to the quantified estimates.

Table 8.10: Omissions, Biases, and Uncertainties and their Effect on the Project

Benefit or cost category	Likely impact on net benefits**	Comment
Recreation	+	Not monetized
** <i>Direction and magnitude of effects on net benefits</i> + <i>Likely to increase net benefits relative to quantified estimates</i> ++ <i>Likely to increase net benefits significantly</i> - <i>Likely to decrease net benefits</i> -- <i>Likely to decrease net benefits significantly</i> +/- <i>Uncertain</i>		

The “Without Project” Baseline

If the Project is not implemented, continued overwatering of parks will carry surface pollutants, nutrients, and metals from the parks and streets into the local creeks, streams, and other water bodies.

Potential Adverse Effects from the Project

Any potential adverse effects from this Project will occur during construction and will be mitigated.

Project Benefit Costs Comparison

The total present value of the Project costs and monetized and qualitative benefits are provided in Table 8.11.

Table 8.11: Benefit-Cost Analysis Overview

	Present Value (In 2009 Dollars)
Costs – Total Capital and O&M	\$849,234
Monetizable Benefits	
Water Supply Benefits	\$612,985
Other Benefits (Recreation, Power, Water Quality)	\$1,214,757
Total Benefits	\$1,827,741
Qualitative Benefits	Qualitative Indicator*
Improved water supply reliability	+
Reduction in pollutant discharge	+
Other Benefits (Recreation)	+/-

	<u>Present Value</u> (In 2009 Dollars)
* <i>Magnitude of effect on net benefits</i> <i>+/- (negligible or unknown)</i> <i>+ (moderate)</i> <i>++ (significant)</i>	

Methods used to Estimate With- and Without-Project Conditions

The annual expected benefits of water quality and other expected benefits are summarized in Table 8.B.1 of Appendix 8.B.

Reduction in Pollutant Discharge

The Project benefits for reducing pollutant discharge were monetized based on avoided treatment costs from a feasibility study recently completed for a water treatment facility in Las Virgenes, using a UV disinfection process (see Appendix x-x for feasibility study). The cost of establishing the facility is about \$4.4 million and the operating cost would be approximately \$240,000/year. It is assumed that about 1/3 of pollutants come from run-off from city-owned facilities, resulting in \$80,000 saving in O&M costs attributing to improving water quality. This equates to approximately \$0.08 per square foot of reduced runoff area.

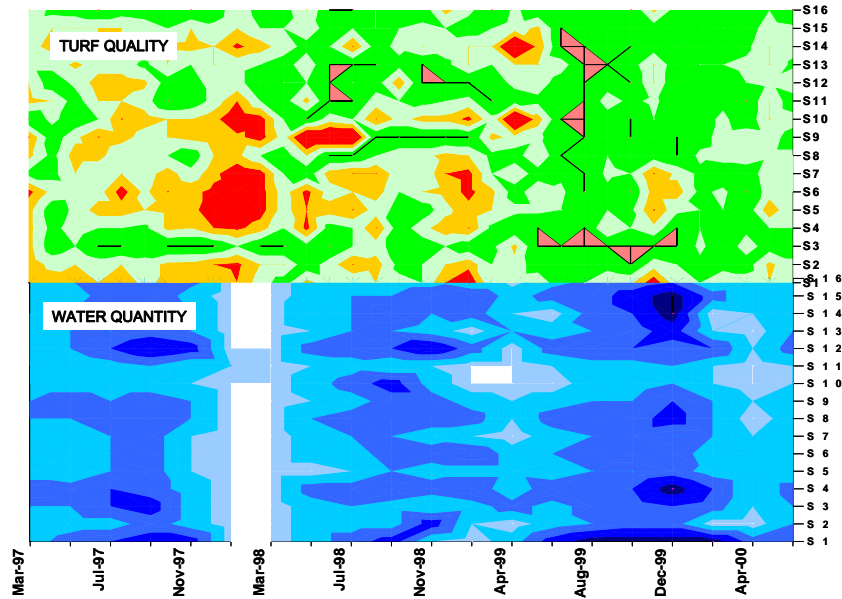
Recreation Benefits

The Project will improve more than 20 acres of landscaped sub-areas by retrofitting existing irrigation systems with smart controller systems. Efficient irrigation practices will improve the aesthetic quality of parks, thereby enhancing recreation quality in the region. The recreational benefits of the Project cannot be monetized.

Power Cost Savings

The Project will create avoided power costs by reducing operation time of the sprinklers. These avoided power costs are associated with reduction in recycling and pumping water. It is estimated that Project will save about 25% on power consumption and costs associated with irrigation for the City. Currently, the cost of electricity to operate city-owned irrigation system is approximately \$6,800 per year. The electricity rate is \$0.19/KWH. Based on a 25% reduction in power consumption, the Project will result in about \$1,700 in annual power cost savings.

Letter Agreement No. 19139
for
Alternative Irrigation Scheduling Methods



Final Report

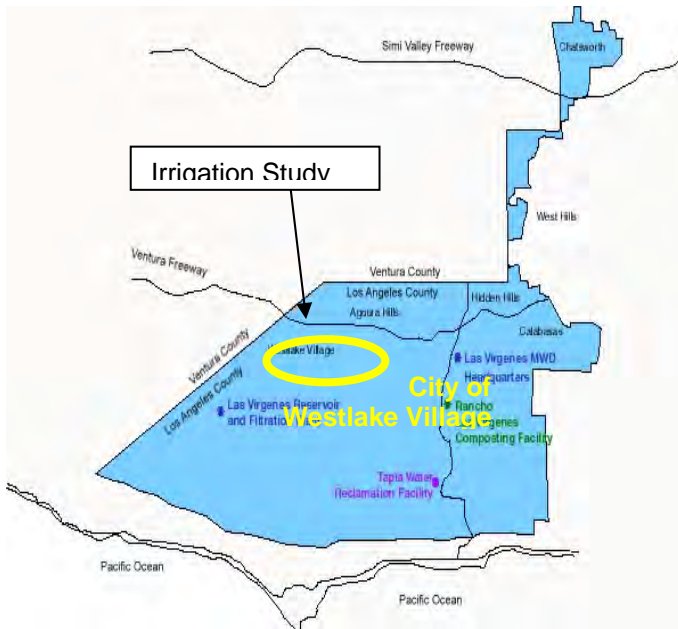


Las Virgenes Municipal Water District
in Partnership with
Metropolitan Water District of Southern California

September 2000

EXECUTIVE SUMMARY

The purpose of this project was to compare the efficiency of four different irrigation scheduling techniques: (1) Soil Moisture Sensors (2) Atmometer (3) Reference Plant Evapotranspiration (4) Professional Judgment. Each method was used to irrigate 16 individually metered sites (4 replicates) in the City of Westlake Village. Turf quality was assessed each month by a panel of four-five independent observers.



The project had three phases. Phase 1 involved measuring each site and collecting 12 months water use data prior to the installation of new equipment and/or irrigation scheduling changes. It began in early 1996 and ran through early 1997. In Phase 2, irrigation controllers, environmental sensors and communications were installed. It began in early 1997 and ran through late 1999 due to equipment failures and repairs. Phase 3 (side by side comparison) began in late 1999 and continues.

Water use data highlight irrigation problems that may be (and probably are) typical of grassy road medians. Every site was found to be watered well-beyond actual ETo demands, apparently due to site topography (road medians with grassy crowns) and inappropriate irrigation equipment. Optimal turf quality typically required twice the water actually used by the turf (200% of ETo). Gutters adjacent to street medians take the excess water directly to storm drains, posing a challenge to cities trying to reduce urban runoff.

None of the irrigation scheduling methods proved useful in this regard, although all of the data-referenced methods (e.g. ETo data or soil moisture data) outperformed professional judgment. Soil moisture controlled scheduling is "blind" to irrigation runoff where over-application is necessary to achieve good coverage and penetration. ETo scheduling reduces water use, but underestimates actual plant demand where applied water runs off too quickly or is otherwise misapplied.

The study was interrupted in 1998 by new water quality regulations that prohibited the District from discharging surplus recycled water into Malibu Creek. To comply with these regulations, the district offered financial incentives to encourage recycled water use in spring and fall (thereby reducing the amount of surplus water that previously would have been sent to Malibu Creek). High water use during phase 2 and 3 may therefore be an artifact of these incentives.

INTRODUCTION AND PROJECT HISTORY

About 70 percent of the water served by the Las Virgenes Municipal Water District (LVMWD) is used outdoors for landscape irrigation (North American Residential End Use Study, 1998). The majority of this water is delivered by irrigation systems controlled by timers according to a user-defined schedule. Historically, these schedules are set based on professional judgement, but new tools are available that can either directly set irrigation controllers (e.g. soil moisture sensors) or inform professional judgment. This project was intended to study whether these new methods provide superior irrigation with respect to water conservation.

Appendix A provides a historical overview of the study. Project start-up took much longer than planned due to equipment failures, inconsistent cooperation with the City's landscape contractor, and conflicts with district staff workloads. Some of the equipment failures related to difficulties with the installation and reliable operation of the district's weather station, while others affected on-site equipment such as irrigation controllers and communications. Due to these delays, the district did not begin collecting test data until October 1999. These delays were somewhat mitigated by the fact that 1998 was an unusually wet year, which likely would have skewed the results in favor of the soil moisture sensor treatment.

A more serious problem affecting the project was the renewal of the district's NPDES permit for its water treatment facility. In November 1997 this permit was modified to prohibit the disposal of surplus recycled water in Malibu Creek. No time for compliance was allowed, and violations result in large fines. Therefore, the district had to take immediate steps to reduce the volume of surplus recycled water during the prohibition period (originally May 1 through October 31, later extended to April 15 through November 15). One of these steps was to encourage recycled water use through financial incentives. Users were notified that they would not be charged for any water use in excess of their 1997 baseline year usage. Public agencies in particular took full advantage of these incentives. This directly affected the water use in this study, since the City of Westlake Village owns all the sites.

METHODS

Sixteen street medians planted with turf were divided into four groups irrigated according to one of the following methods (2-4 are referred to as "data referenced" methods elsewhere in this report):

1. Professional Judgment by Landscape Contractor
2. ETo data provided by local weather station
3. Soil Moisture Sensor
4. ETo data provided by local Atmometer

Site locations, landscaped area, submeter locations, irrigation controller descriptions and other relevant irrigation system information are provided in Table 1. All sites were located in the City of Westlake Village (See map). The decision to use street medians as test sites was motivated by their relatively uniform character, which serves to reduce the confounding effects of extraneous variables. All the sites were managed by one owner (City of Westlake Village), which made the project easier to administer. However, the use of street medians had some unanticipated effects on water use (see discussion).

Despite their topographic similarities, many of the sites had sub-standard irrigation systems at the outset of the study, including broken and clogged fittings, dysfunctional controllers, and areas of irregular turf. Accordingly, all sites were brought to a more uniform standard with respect to irrigation heads, system tune, and new controllers. Turf quality was judged by an independent panel throughout the course of the study.

Water use was tracked by the installation of water submeters to each irrigated area with bi-monthly reading of the submeters by district customer service staff during their normal billing routes. For comparisons between sites and treatments, all water use data were converted to a percentage of ETo using average ETo values during each billing cycle. ETo data for this purpose were generated from the district's Calabasas weather station (<http://www.lvmwd.dst.ca.us/cons/con3et.html>).

Analysis of Variance (ANOVA) was used to identify significant variance in water use between sites within treatments. Student's T-Test was used to identify significant differences in mean water use between treatments. In every case the rejection criterion was based on $P < 0.05$ for the probability of observing a particular difference by chance. Separate tests were performed for mean water use between sites (within groups) and between treatments (groups), before and after equipment installation. Statistical analysis by season was not done for post-installation trials due to the small dataset ($N = 3$, or three billing cycles covering January - June 2000).

All data collected during the study are provided in Appendices B and C. Statistical test results are provided in Appendix D.

RESULTS

WATER USE

Regardless of the irrigation method or the project phase (i.e. pre-installation versus post-installation), water use consistently exceeded need, averaging 170 percent of reference plant evapotranspiration (ET_o) on an annual basis (Fig. 1). Variability in water use was also quite high throughout the study with the exception of those sites under local Atmometer control, which had no significant variability either before or after the test.

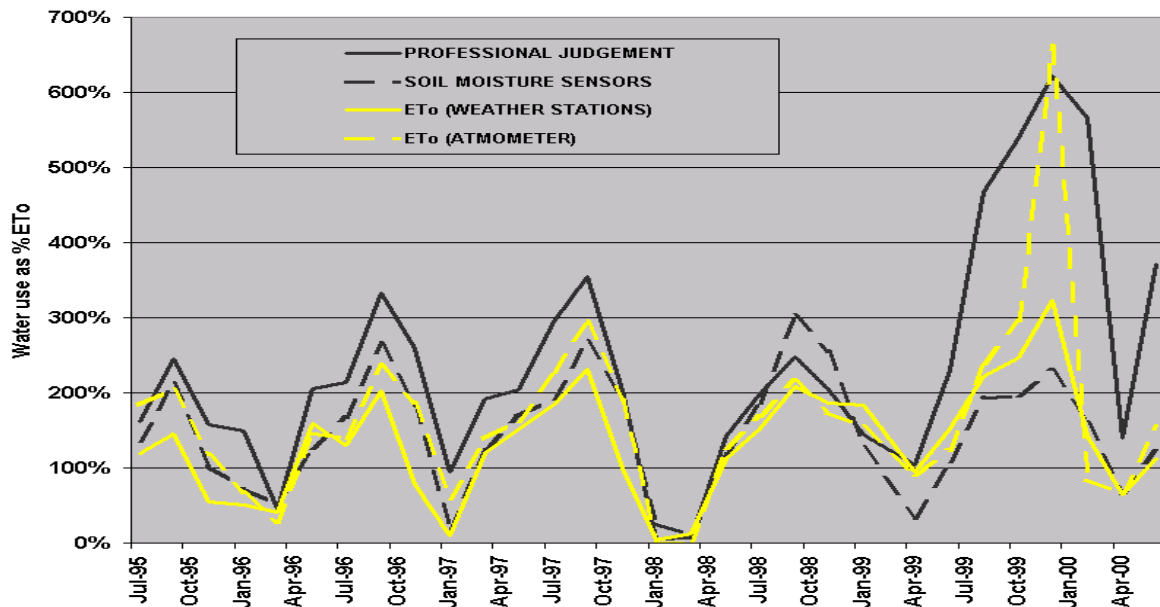


Figure 1. Overall Water Use During the Study as % of Plant ET_o

Professional Judgment used significantly more water than any of the data-referenced¹ scheduling methods (Table 2 and 3). This result initially was thought to be due to unusually high water use in Site 5, one of the sites irrigated by Professional Judgment². Site differences were then statistically tested (ANOVA), with significant differences found in Treatment 1 (Professional Judgment), Treatment 2 (Weather Station) and Treatment 3 (Soil Sensor) but not 4 (Atmometer). ANOVA was then applied to the Treatment 4 sites, testing the pre-installation variance against the post-installation variance. No significant difference was found, suggesting that the lower variance in water use should not be attributed to the post-installation irrigation method (Atmometer).

¹ Data referenced irrigation scheduling refers to controller adjustment by an operator using ET_o information or other measure of water demand.

² Note that the sites were renumbered in the statistical analyses (appendices) for ease of calculation. Site 5 in the field became Site 1 in the analysis.

Given the variance between sites, water use statistics were calculated for each Irrigation Method with and without the highest water-using site in each treatment (Table 2). However, omitting the high use “outliers” did not affect the results; the order of relative water use *efficiency* remained ETo (weather station) > Soil Moisture Sensors > ETo (Atmometer) > Professional Judgment. When tested statistically, this order became ETo (weather station) = Soil Moisture Sensors = ETo (Atmometer) > Professional Judgment (Table 3).

Table 2. Water Use Comparisons. Note all sites prior to 2000 were irrigated by professional judgment. Each category is an average of four sites.

YEAR	BILLING PERIOD	IRRIGATION SCHEDULE METHOD			
		PROFESSIONAL JUDGEMENT	ETo - WEATHER STATION	SOIL MOISTURE SENSOR	ETo - ATMOMETER
1995	4	161%	120%	136%	184%
	5	246%	145%	212%	203%
	6	157%	54%	103%	118%
1996	1	150%	50%	73%	67%
	2	46%	41%	53%	28%
	3	205%	159%	126%	147%
	4	214%	130%	166%	139%
	5	333%	203%	265%	236%
	6	259%	78%	184%	186%
1997	1	95%	10%	18%	58%
	2	191%	120%	124%	139%
	3	204%	152%	169%	162%
	4	294%	184%	192%	227%
	5	355%	231%	268%	295%
	6	202%	100%	189%	191%
1998	1	6%	3%	26%	1%
	2	6%	12%	10%	0%
	3	142%	113%	118%	126%
	4	198%	152%	186%	169%
	5	248%	208%	303%	216%
	6	204%	187%	255%	174%
1999	1	144%	184%	127%	154%
	2	104%	95%	33%	90%
	3	231%	151%	108%	123%
	4	467%	222%	193%	238%
	5	540%	246%	196%	296%
	6	622%	323%	231%	661%
2000	1	566%	143%	160%	85%
	2	140%	64%	65%	66%
	3	371%	113%	122%	155%
Average Water Use		237%	118%	152%	159%
Standard Deviation		153%	63%	72%	72%
Average - Top Using Site Omitted		183%	119%	121%	151%
St. Dev. - Top Using Site Omitted		118%	76%	80%	111%
Average Turf Score (see text)		3.7	3.4	3.7	3.9

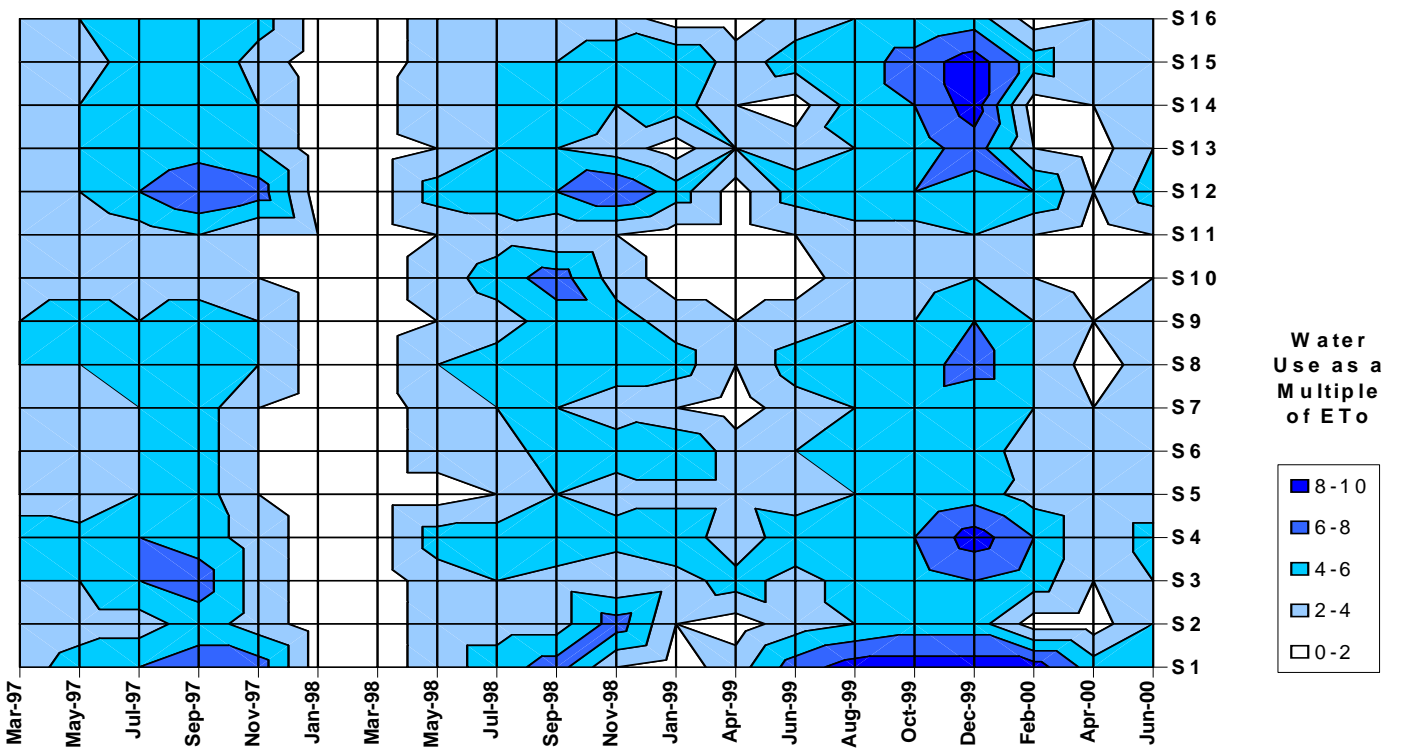
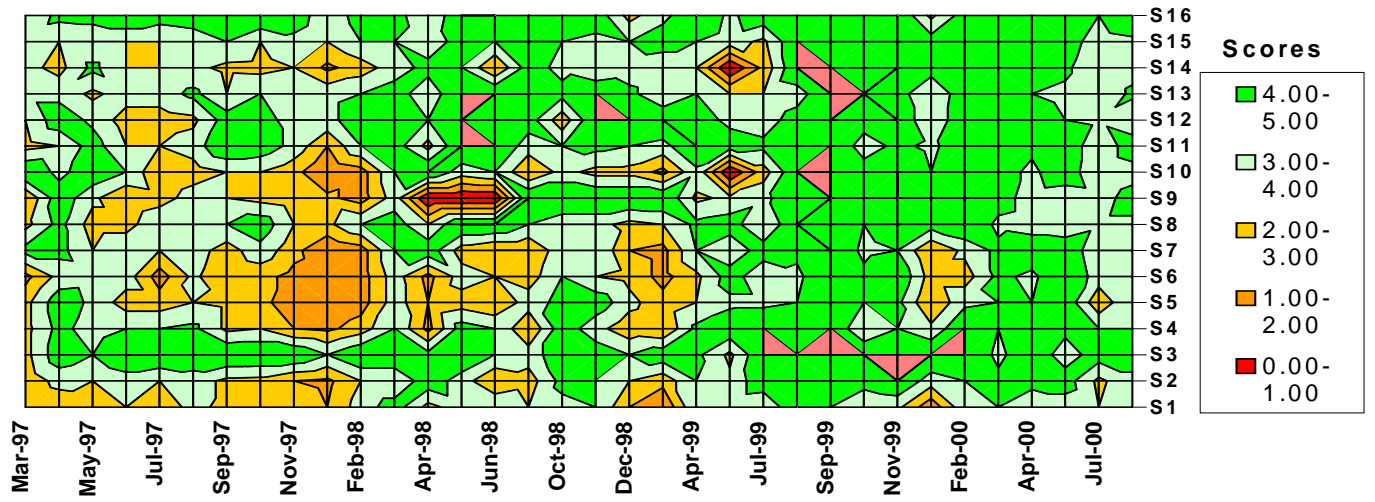
Table 3. Water Use Comparisons Before and After Equipment Installation. Note all Pre-Test sites were irrigated by professional judgment. NS=No significant difference.

T-TESTS UNEQUAL VARIANCE, 0.05 REJECTION CRITERIA			
PRE-TEST	SITES 1-4	SITES 5-8	SITES 9-12
SITES 1-4	-	-	-
SITES 5-8	NS	-	-
SITES 9-12	NS	NS	-
SITES 13-16	Sites 13-16 better	NS	NS
POST-TEST	PROFESSIONAL JUDGEMENT (Sites 1-4)	ET _o WEATHER STATION (Sites 5-8)	SOIL MOISTURE SENSOR (Sites 9-12)
PROFESSIONAL JUDGEMENT (Sites 1-4)	-	-	-
ET _o WEATHER STATION (5-8)	ET _o Better	-	-
SOIL MOISTURE SENSOR (9-12)	Soil Sensor Better	NS	-
ET _o ATMOMETER (13-16)	NS	NS	NS

Table 3 used all available data for the “pre-test” (1995 – 1999) comparisons. However, recognizing that these data include summer and fall months not available for the “post-test” phase, a separate analysis was run that was limited only to billing cycles 1-3 (which exclude the summer and fall months). No difference in the result obtained. A third analysis omitted all of the 1998 and equipment failures in 1999 that necessitated occasional switching back to professional judgment occasionally for sites 5-16. No difference in the result obtained.

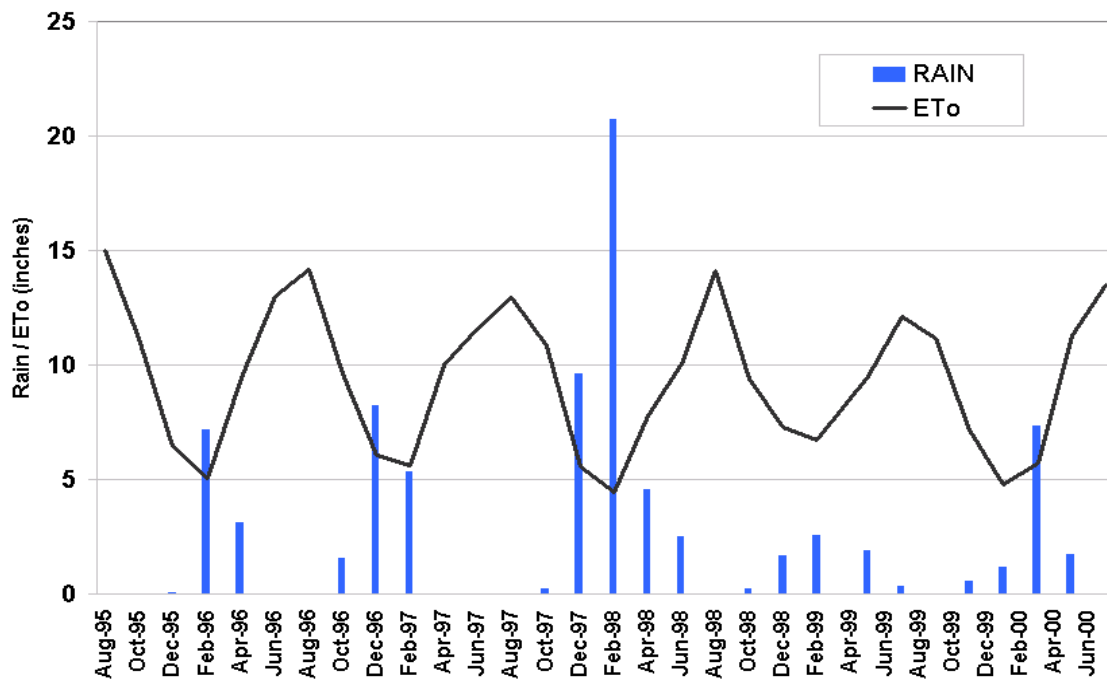
TURF QUALITY

Turf quality generally improved at all sites during the study, although significant deterioration was observed between November 1997 and February 1998 (Fig. 2). Reference to the judging sheet comments found that the deterioration seen in late 1997 and early 1998 was due at least in part to scalping of the turf at sites 1-12 (November) and 1-16 (post-November through February). However, this period also coincided with a period of low water use (Fig. 3). Statistical tests between judges found no significant differences in their scores; the panel appeared to rank the sites consistently over the course of the study.



The apparent under watering represented by the white areas in Figure 3 generally correspond to periods of rainfall (Fig. 4). Theoretically, soil moisture based irrigation should account for this natural irrigation better than the other methods. In practice, the data collected in this study were insufficient to test this.

Fig. 4. Rain events and Plant Evapotranspiration (ET_o) during the study



DISCUSSION

Overall, water use appeared very high relative to plant water demand (ET_o) at all of the test sites, both before and after the installation of alternative irrigation scheduling systems. This result was surprising, insofar as ET_o controlled irrigation scheduling should not have allowed water use in excess of about 110% of ET_o. Further investigation found that “ET_o controlled” is somewhat of a misnomer. In practice, the linkage between fluctuations in ET_o and irrigation is via a percentage adjustment feature on the irrigation controllers. If ET_o drops by 20 percent, for example, then the controller reduces volume applied by 20 percent. True ET_o based irrigation therefore requires that the actual baseline volume is calibrated to the actual volume required to supply ET_o, which in turn is done by measuring the area irrigated and selecting an appropriate ET value for the specific plant species planted there. This was done at the outset of the study

for the ETo referenced test sites, but base flows apparently were reset by on-site managers at higher levels following data interruptions and equipment malfunctions

Another surprising finding was that this over watering did not result in significantly poorer turf quality. On the contrary, it improved with irrigation well in excess of 100% ETo. Further investigation finds that this was due to the irrigation system itself, i.e. much of the excess water was not reaching the turf. This is due to the character of the street medians themselves, specifically their “crown” topography. Water had to be applied in excess of ETo for it to reach the entire site. Other factors also played a role, including poor maintenance of the emitters (height adjustments, clogged or broken emitters, etc.) and infrequent supervision.

Each irrigation method has its pros and cons, some of which were highlighted in this study. For example, the use of weather-station derived ETo data on a website presumes that (1) landscape maintenance staff will download the data and set their irrigation controllers using the data, and (2) that this will be done frequently enough to realize a benefit (at least weekly). The use of atmometers presumes their reliability; in this study some atmometer-scheduled sites repeatedly reverted to professional judgment due to equipment problems. The Weather Station ETo system is fairly robust, insofar as data losses of up to several days can be tolerated given the day-to-day variation is on the order of a few percent (exceptions are when weather fronts pass through the area). However, efficiencies can only be realized if the base flows themselves are set to actual ETo demand, and not reset to some other baseflow during the year. Without this step, ETo controlled irrigation will merely adjust the baseflow in synchrony with ETo fluctuations. If the baseflow is 200 percent of ETo then these adjustments will fluctuate around this value.

It is hard to judge the impact on the study results from the “use more water” incentive program referred to in the Introduction and Executive Summary. On the one hand, these incentives were not offered throughout the term of the test phase (Jan 2000 through July 2000), so water use may have been affected only while discounted water was available. On the other hand, improved turf quality seen at most sites over the course of the study may reflect increased irrigation during the incentive program, even though these incentives were limited to spring and fall. Also, irrigation practices that were altered to take advantage of the incentive program may not have been reset to pre-incentive volumes even after the incentive program ended. This effect would be limited to the “landscape manager irrigated” test plots and those automated irrigation test plots that experienced automation failures (and thus were temporarily irrigated by manager judgment).

SUMMARY AND FUTURE DIRECTIONS

1. This study should not be viewed as a robust test of the four irrigation methods tested, due to the short test period (9 months), equipment malfunctions during the test period, and the potential confounding effects of an incentive program intended to encourage recycled water use.
2. Despite these difficulties, the study yielded the following useful information:
 - a. Turf-planted street medians are good candidates for water savings. This study demonstrated remarkably inefficient water use, traceable to their crown topography coupled with spray emitters. This combination guarantees substantial runoff to achieve uniform saturation of turf. Remedies include subsurface irrigation with spray emitters reserved for hard to reach areas, coupled with a reverse-crown topography (swale). The proximity of street medians to gutters and storm drains presents a disproportionate impact on urban runoff, and this also argues for better care in their irrigation.
 - b. Data referenced scheduling cannot be merely “grafted” onto an existing irrigation system. Spot checks by staff repeatedly found that irrigation controllers had been reset, soil moisture scheduling had been overridden, and baseflows reset at flows in excess of ETo. In some cases these operator adjustments were warranted given the nature of the particular site. ETo scheduling will under water planted areas served by inefficient irrigation systems.
 - c. Even with an efficient irrigation layout and well-serviced equipment, ETo scheduling can still result in inefficient watering if the baseflow is incorrect. This could result from an inaccurate planted area calculation or the use of the wrong ETo value (e.g. misidentified plant species). Most ETo referenced scheduling is done by the percent adjust feature of irrigation controllers.
 - d. The study highlights the need to better educate and motivate landscape maintenance contractors. Potential remedies suggested by this study include maintenance contracts that include penalties for over irrigation³, action by regulatory agencies against property owners for urban runoff⁴, and more automation to more closely couple irrigation to efficient watering indices such as ETo and soil moisture⁵.

³ These have been used successfully in Orange County, California (Tom Ash, personal communication)

⁴ Landscape runoff is conditionally exempt under current water quality regulations governing non-stormwater discharges to receiving waters. The condition is that they do not pose a significant risk of water quality impairment, and can be modified or revoked by the Executive Officer of the Regional Water Quality Control Board.

⁵ Irvine Ranch Water District is piloting the use of new instrumentation to directly link irrigation controllers with ETo data from on-site weather stations.

APPENDICES

- A. Study History
- B. Water Use by Site and Date
- C. Turf quality – Average Scores by Date and Site
- D. Within Treatment ANOVA
- E. Professional Judgment vs Other Methods (ANOVA)
- F. ETo Weather Station vs Other Methods (ANOVA)

(Note: ANOVA results for other comparisons are included in E and F)

- G. August – September Water Use as ETo % (Graph)
- H. January – February Water Use as ETo% (Graph)

