SEELEY AREA
DRAINAGE MASTER PLAN

Job Number 16101
June 2010

RICK ENGINEERING COMPANY

SEELEY AREA

DRAINAGE MASTER PLAN

JUNE 2010

Prepared For:

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A - CD Containing digital HEC-RAS, GIS, and CAD files.
B – Existing Condition Hydrologic Exhibit
C – Ultimate Condition Hydrologic Exhibit
D – Capital Improvement Program Report

1.0 INTRODUCTION

This document summarizes the findings of the Drainage Master Plan (DMP) prepared for the Community of Seeley, California, located within Imperial County. The California Housing and Community Development Department (HCD) through its Community Development Block Grant (CDBG) funded the development of this DMP.

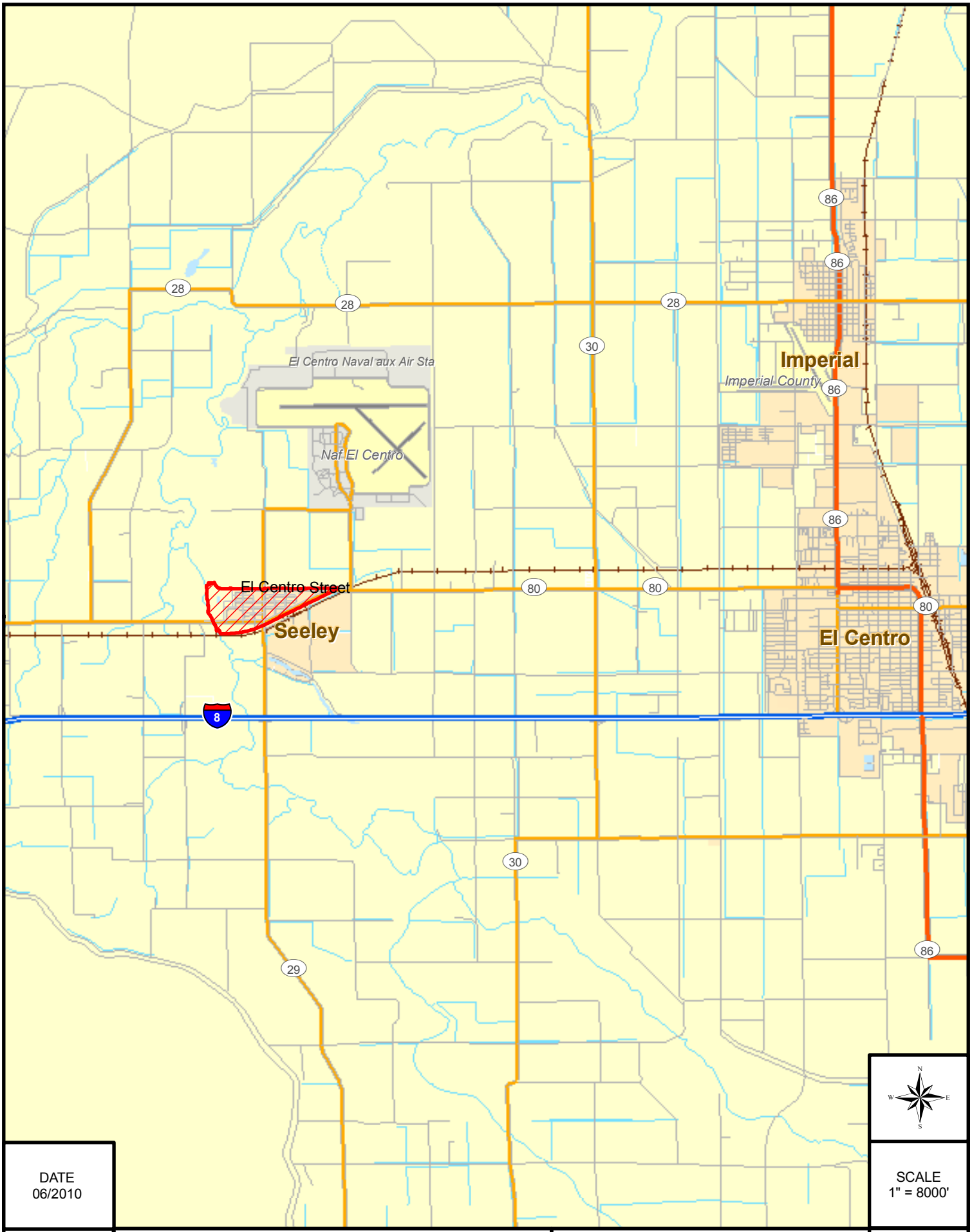
1.1 Purpose of DMP

The purpose of this DMP is to identify current drainage and flooding characteristics within the Community of Seeley, and determine recommended drainage improvements to reduce flood hazards and improve public safety. Drainage improvements recommended in this report will be based on the criteria outlined in the current Imperial County design standards.

The following information is provided within this DMP:

- Existing Condition topographic information for the Seeley Community, as of March 2009.
- Existing Condition 25-year and 100-year peak flow rates and drainage patterns
- Ultimate anticipated 25-year and 100-year peak flow rates and drainage patterns
- Recommended drainage improvements including storm drains, inlets, retention areas, and outlet locations.
- Opinion of probable construction costs for each recommended phase of the drainage improvements
- Prioritization of recommended drainage improvements for implementation

The results of the DMP calculations were used to develop a Capital Improvement Program Report that outlines the recommended drainage improvements for implementation, and is attached with this DMP as Appendix D.



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Seeley Area Drainage Master Plan
Vicinity Map

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EXHIBIT
1.2

1.3 Computer Programs

The following computer programs were used for preparation of the Seeley Area DMP:

- AutoCAD 2002
- US Army Corps of Engineers, Hydrologic Engineering Center - Hydrologic Modeling System, HEC-HMS v. 3.3.
- ArcGIS, version 9
- Microsoft Excel

1.4 Limitations

The Seeley Area DMP is a comprehensive plan for future drainage needs within the Seeley Community. This report has been prepared for master planning purposes only, as a guide for engineers, planners, developers, and County staff. Detailed engineering calculations and investigations should be prepared for the implementation of any of the facilities outlined in this study.

2.0 PROJECT APPROACH

The Seeley Area DMP covers approximately 0.556 square miles (356 Acres) of the developed area within Seeley, California, known as the Seeley Townsite. The limits of the DMP are shown on the Vicinity map in Section 1.0. Seeley is located approximately 8 miles west of El Centro and 1.5 miles North of Interstate-8, within Imperial County California. Seeley is bordered on the west by the New River.

2.1 Previous Drainage Plan

A previous drainage master plan titled "Seeley Streets Overlay and Drainage Plan" was prepared circa 1975, for the Seeley Area (Reference 9). The previous plan recommended the use of drainage swales along major roadways as the method for conveying storm runoff to the New River. The improvements recommended in the previous study were constructed and as-built in 1979. However, this design approach did not take into consideration public safety factors related to the proximity to the local schools, etc. In addition, the terrain within the Community of Seeley is very flat, and therefore, a significant amount of ponding occurs within the streets and low-lying areas during and after rainfall events.

2.2 HEC-HMS Program

The hydrologic modeling was prepared using US Army Corps of Engineers, Hydrologic Engineering Center - Hydrologic Modeling System, HEC-HMS v. 3.3. HEC-HMS is public domain software designed for modeling the precipitation-runoff processes that occur in watershed systems. It is designed to be applicable in a wide range of geographic areas including for use in small urban or natural watershed runoff situations. Hydrographs produced by HEC-HMS can be used directly or in conjunction with other software for studies of urban drainage, future urbanization impact, reservoir design, flood damage reduction, floodplain regulation, drainage master planning.

2.3 GIS Data Processing

GIS tools were utilized to calculate spatial factors related to the development of the hydrologic modeling for the Seeley Area. Information including land use, hydrologic soil data, and terrain information were compared with existing drainage patterns and drainage areas to calculate factors such as runoff length, slope, time of concentration, drainage area, curve number, and percent impervious. Detailed discussion of the hydrologic parameters used in the preparation of this DMP is included in Section 3.0 of this report.

3.0 SUMMARY OF BASE INFORMATION

The following provides a summary of the base information used in the preparation of the Seeley Area DMP. Rick Engineering Company is not responsible for any future changes to the topographic information, land use information, drainage facilities, or any other base information used in the preparation of this DMP that may occur after the preparation of this report.

3.1 TOPOGRAPHY & ORTHO IMAGERY

The following summarizes the source information of the base topography generated for the preparation of the DMP:

Date of Survey:	March 24, 2009
Contour Interval:	1-Foot
Horizontal Datum:	NAD 83, CCS Zone 6, 2007.0 EPOCH
Vertical Datum:	NAVD 88

Date of Photography:	March 24, 2009
Approximate Photo Scale:	1”= 300’
Pizel Size:	0.25 feet

It should be noted that the elevations in the Seeley Community are below Sea Level. Therefore, 1,000 vertical feet were added to the elevations in Seeley. The adjusted elevations range from 899 feet to 967.5 feet.

3.1.1 DRAINAGE BASIN BOUNDARIES

Hydrologic modeling for the Seeley area was prepared utilizing the base topography obtained for this project. The limits of the overall drainage study, and corresponding drainage basin boundaries were confined to the surveyed topographic area and were determined based on the high points surrounding the Seeley area. The terrain within the Seeley Townsite identified that no significant drainage areas outside of the townsite

limits flow into the community of Seeley due to the existing topography and the existence of Imperial Irrigation District canals along the northern limit of the community that prevent run-on from adjacent areas. The watershed tributary to the New River was not analyzed in this study.

3.2 PRECIPITATION DATA

2-year and 100-year precipitation values were obtained from the Imperial Irrigation District (IID) DRAFT Hydrology Manual (Reference 7), Figures B-1 through B-4. Table 3.2.1 summarizes the precipitation information obtained from the IID manual.

3.2.1 TABLE OF PRECIPITATION INFORMATION

Duration	Precipitation (Inches)	
	2-Year	100-Year
1-hour	0.38	1.35
24-Hour	0.96	2.80

3.2.2 INTENSITY-DURATION CALCULATIONS

The rainfall intensity at differing durations storms is required for modeling the 25-year and 100-year storm events reflected in this DMP. Therefore, the following formula was utilized to convert the above noted precipitation values into intensities at varying storm durations.

For storm durations less than 1-hour:

$$\mathbf{Yp = Y_2 + [\ (Y_{100} - Y_2) * Kp\ ] / 263}$$

where:

Kp = Constant associated w/ Return Period P

5-yr = 65 10-yr = 108
25-yr = 164 50-yr = 215

Y2 = Intensity associated with the 2-year return period

Y100 = Intensity associated with the 100-year return period

Yp = Intensity at Return Period P

The Kp value for the 25-year storm event was obtained from Appendix II and Figure D-4 in the DRAFT IID Hydrology Manual.

For storm durations between 1-hour and 24-hours logarithmic interpolation was utilized to determine intermediate values from the precipitation depths shown in Table 3.2.1. Additional guidance on the development of rainfall depths and intensities for varying storm events can be found in Section D of the Imperial Irrigation District DRAFT Hydrology Manual (Reference 7).

3.2.3 TABLE OF CALCULATED INTENSITY AND PRECIPITATION INFORMATION

	Intensity (Inches/Hour)			**Precipitation (Inches)**		
Duration	2-Year	25-Year	100-Year	2-Year	25-Year	100-Year
5-min	1.50	3.90	5.35	0.13	0.33	0.45
15-min	0.91	2.36	3.24	0.23	0.59	0.81
60-min	0.38	0.98	1.35	**0.38**	0.98	**1.35**
120-min	0.23	0.58	0.79	0.47	1.16	1.58
180-min	0.17	0.43	0.58	0.52	1.28	1.74
360-min	0.11	0.25	0.34	0.64	1.49	2.04
720-min	0.07	0.15	0.20	0.78	1.74	2.39
1440-min	0.04	0.09	0.12	**0.96**	2.11	**2.80**

The methodology used to calculate the intensities shown in Table 3.2.3 are described in section 3.2.2 of this report. Precipitation values for other than the 2-year and 100-year, 1-hour and 24-hour duration storms were calculated based on multiplying intensity (inches/hour) times duration (hours), to determine the precipitation in inches.

3.3 LAND USE

Hydrologic modeling for the Seeley area was prepared based on two land use scenarios, the current condition as of the authoring of this report and the ultimate planned development within the study area.

3.3.1 EXISTING CONDITION (ZONING)

Existing Condition Land Use data was provided by Imperial County, as shown on the land use zoning "Map 9A" dated May 11, 2006. The land use zoning was compared with the aerial imagery obtained March 2009, and currently vacant parcels of significant size were manually designated as "open space" for the existing condition land use. Exhibit 3.4.1 shows the Existing Land Use zoning designation used for the hydrologic modeling. Table 4.1.2 summarizes the curve number assigned to each land use category

3.3.2 ULTIMATE CONDITION (GENERAL PLAN)

Ultimate Condition (General Plan) Land Use data was provided by Imperial County, as shown on the exhibit titled "Seeley Urban Area Map" dated September 13, 2004. The general plan land use data was compared with the current condition land use zoning to identify areas of future development or redevelopment. The impacts of the future development were incorporated into the design of the recommended drainage improvements. Exhibit 3.4.2 shows the General Plan Land Use designation used for the hydrologic modeling. Table 4.1.2 summarizes the curve number assigned to each land use category

3.3.3 ASSESSOR'S PARCEL DATA

Assessor's parcel data for the Seeley Area was obtained from the Imperial County GIS division on October 8, 2009. The Assessor's parcel data was utilized to identify approximate existing road right of way, locations of publicly owned parcels, and limits of land use/zoning designations. The assessors parcel boundaries are shown for reference on the exhibits within this report.

3.4 HYDROLOGIC SOIL TYPE

The Seeley Area DMP was prepared taking into consideration the hydrologic soil type in the determination of the loss rates and curve numbers within the watershed. SSURGO 2008 Soil data was obtained from the Natural Resources Conservation Service (NRCS) Soil Data Mart (Reference 4), which includes a classification of soil types ranging from type A to type D. The soil types within the limits of the study area are primarily type C soils with some type D along the New River corridor.

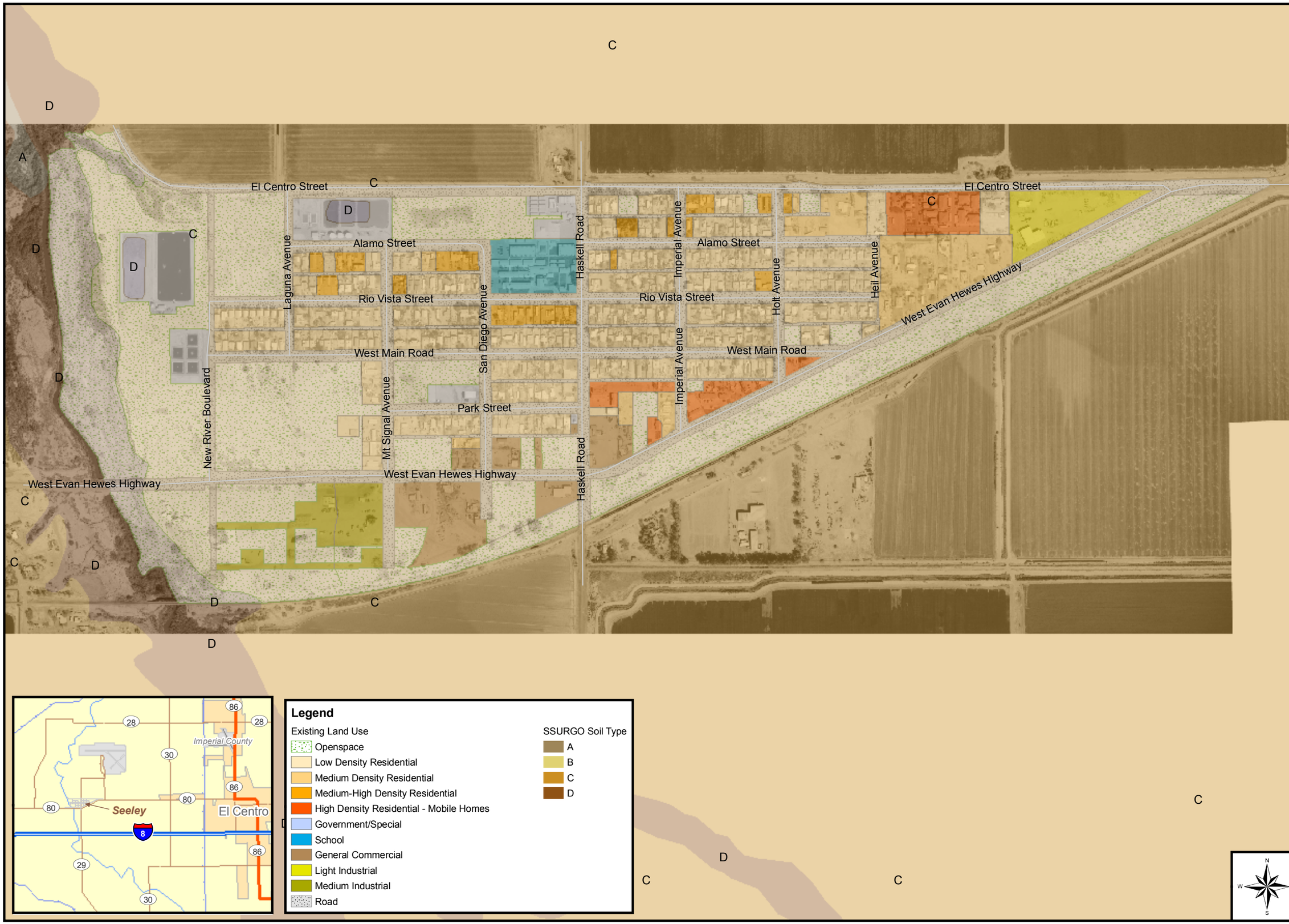
The following summarizes the hydrologic characteristics of the differing soil groups:

Type A: Low Runoff Potential. Soils having high infiltration rates even when thoroughly wetted and consisting chiefly of deep , well-drained sands or gravels. These soils have a high rate of water transmission.

Type B: Soils having moderate infiltration rates when thoroughly wetted and consisting chiefly of moderately deep to deep, moderately well to well-drained sandy-loam soils with moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission.

Type C: Soils having slow infiltration rates when thoroughly wetted and consisting chiefly of silty-loam soils with a layer that impedes downward movement of water, or soils with moderately-fine to fine texture. These soils have a slow rate of water transmission.

Type D: High Runoff Potential. Soils having very slow infiltration rates when thoroughly wetted and consisting chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface, and shallow soils over nearly impervious material. These soils have a very slow rate of water transmission.



Legend

Existing Land Use
- Openspace
- Low Density Residential
- Medium Density Residential
- Medium-High Density Residential
- High Density Residential - Mobile Homes
- Government/Special
- School
- General Commercial
- Light Industrial
- Medium Industrial
- Road

SSURGO Soil Type
- A
- B
- C
- D

DATE
06/2010

SCALE
1" = 600'

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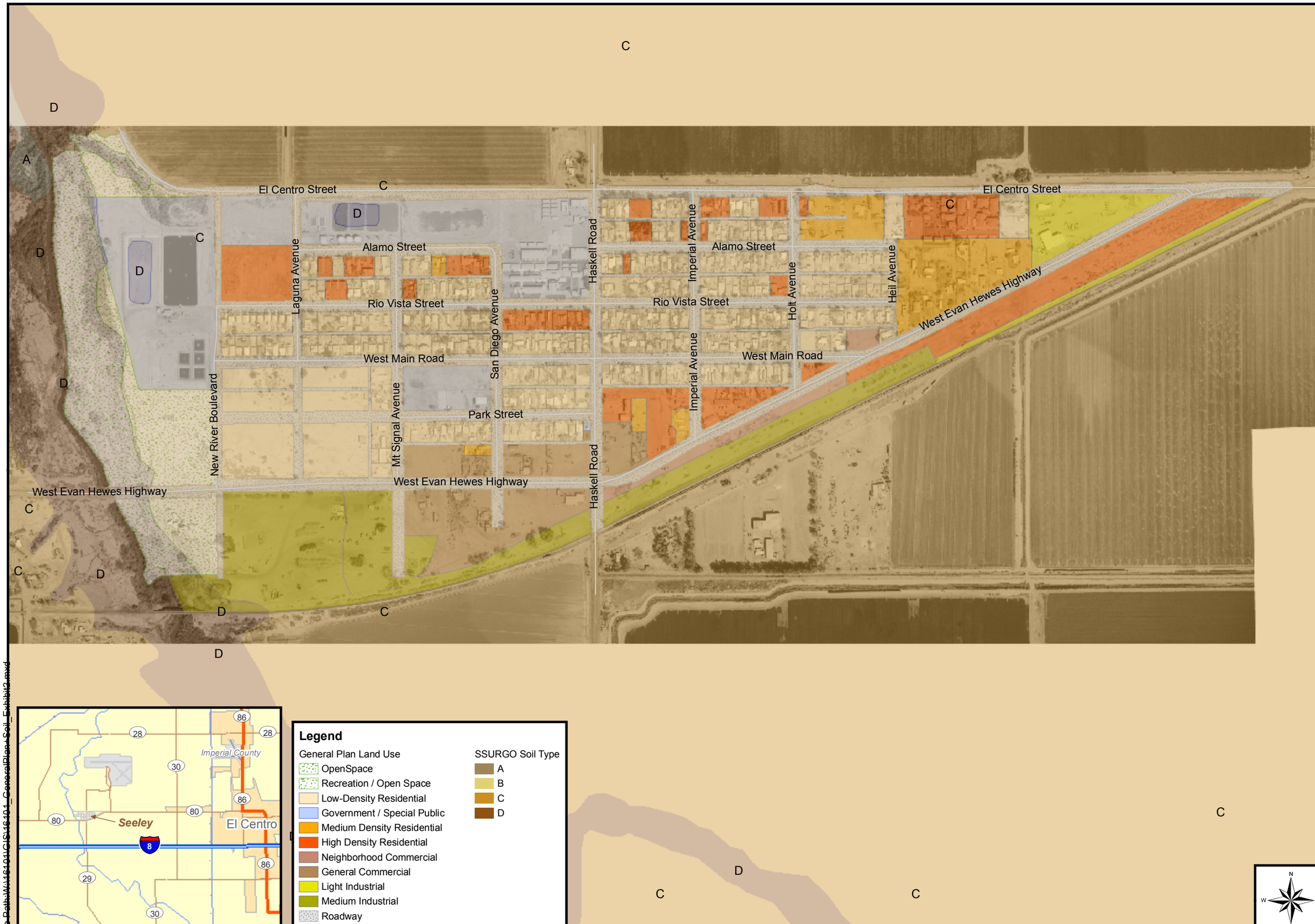
Seeley Area Drainage Master Plan
Existing Land Use Zoning
and Hydrologic Soil Data

EXHIBIT
3.4.1

File Path:W:\16101\GIS\16101_ExistingZoning+Soil_Exhibit1.mxd



DATE
06/2010

SCALE
1" = 600'

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Seeley Area Drainage Master Plan General Plan Land Use Zoning and Hydrologic Soil Data

EXHIBIT
3.4.2

File Path: W:\146101\GIS\146101_GeneralPlan_Soil_Exhibit2.mxd

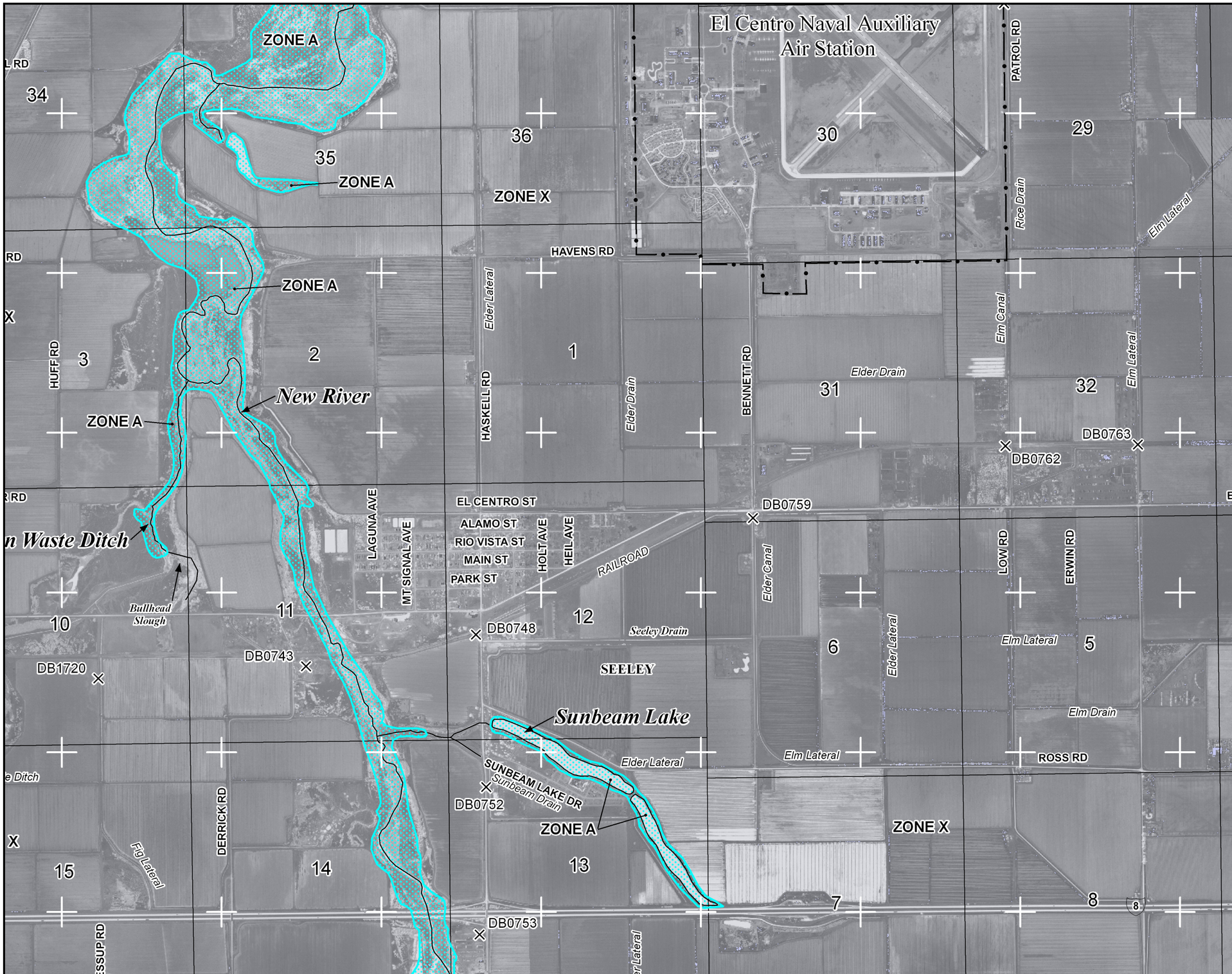
3.5 EXISTING DRAINAGE FACILITIES

A minimal number of engineered drainage structures currently exist within the Community of Seeley. Some recently constructed developments have included design and construction of on-site retention basins in accordance with Imperial County Criteria. In addition, there are a few isolated locations where drain inlets and storm drains have been constructed, however these systems function as retention facilities by storing runoff from the tributary areas as they have no identified discharge locations. The existing condition hydrologic analysis within this DMP considers the impact of the known retention facilities in developing the peak discharges for the study area. Currently there are no constructed or engineered drainage outlets into the New River. Runoff discharges to the New River via overland flow.

3.6 NATIONAL FLOOD INSURANCE PROGRAM

Imperial County is a participant in the National Flood Insurance Program (NFIP), which provides flood insurance and oversees floodplain management regulations to reduce the potential for flood damages. The Federal Emergency Management Agency (FEMA) manages the NFIP.

The FEMA Special Flood Hazard Area (SFHA) for Seeley is identified on Flood Insurance Rate Map (FIRM) panel No 06025C1700C, effective September 26, 2008, attached as Exhibit 3.6.1. The FIRM identifies portions of the New River as a Zone A floodplain, indicating areas subject to inundation by the 1-percent-annual-chance flood event generally determined using approximate methodologies. The FIRM also identifies the remaining areas of the FIRM as Zone X (unshaded), indicating areas of minimal flood hazard, which are the areas outside the SFHA and higher than the elevation of the 0.2-percent-annual-chance flood. Any future construction activities within the limits of the SFHA are required to comply with the requirements of FEMA and the NFIP.



MAP SCALE 1" = 2000'

00 0 2000 4000 FEET

METE

NFIP

PANEL 1700C

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

IMPERIAL COUNTY, CALIFORNIA

AND INCORPORATED AREAS

PANEL 1700 OF 2300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
IMPERIAL COUNTY, UNINCORPORATED AREAS	060065	1700	C

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject

MAP NUMBER
06025C1700C

EFFECTIVE DATE
SEPTEMBER 26, 2008

Federal Emergency Management Agency

Exhibit 3.6.1

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

4.0 HYDROLOGIC METHODOLOGY

Hydrologic Modeling for the Community of Seeley study area was prepared following the criteria outlined in the Imperial Irrigation District (IID) DRAFT Hydrology Manual (Reference 7). Rational method precipitation and intensity information was utilized to reflect peak runoff consistent with rational method calculations, however NRCS (SCS) modeling parameters were utilized to reflect the volume of runoff generated by the watershed and to incorporate the impacts of storage and attenuation on peak flows.

4.1 NRCS (SCS) METHODOLOGY

The Natural Resources Conservation Service (NRCS), formerly known as the Soil Conservation Service (SCS) developed an approach to calculate runoff from a tributary watershed as a function of the drainage area, precipitation, initial abstraction, soil storage potential, and runoff curve number.

4.1.1 CURVE NUMBER

Curve Number for each watershed was calculated as a function of the land use within each area and the hydrologic soil type. Runoff Curve Numbers are an indication of runoff potential for a given area. The higher the Curve Number for a given watershed, the higher the runoff potential. Runoff Curve Numbers were determined based on from Figure C-2 of DRAFT IID Hydrology Manual and Table 2-2a in TR-55 (Reference 8). A detailed description of the runoff curve number values assigned to each land use designation is included in Table 4.1.2.

4.1.2 TABLE OF CALCULATED CURVE NUMBERS BASED ON LAND USE

Existing Condition Land Use Designation	Category	General Plan Land Use	Description	Estimated % Impervious *	Curve Number (AMC II)**	
					Type C Soil	Type D Soil
Openspace – Annual Grasses	OS	Open Space	Poor cover	0%	86	89
Low Density Residential (LDR)	R1	Low-Density Residential	1 DU/Parcel (max density 5 du/acre)	50%	90	92
Medium Density Residential (MDR)	R2	Medium Density Residential	1 – 2 DU/Parcel – duplexes (max density 10 du/acre)	70%	94	95
Medium-High Density Residential	R3	- -	2+ Du/Parcel (max density 29 du/acre)	75%	95	96
High Density Residential and Mobile Homes	R4	High Density Residential	Mobile home parks	85%	96	97
Light Commercial	C1	Neighborhood Commercial	In residential areas	85%	96	97
General Commercial	C2	General Commercial	Along highways, shopping centers	90%	97	98
Government/Special	GS-S	Government/Special	School	70%	94	95
	GS	Government/Special	Other G/S lands	80%-95%	96-98	97-98
Light Industrial	M1	Light Industrial	Storage & manufacturing	90%	97	98
Medium Industrial	M2	Medium Industrial	- -	95%	98	98
Roadway/Paved	ROAD	Roadway	Roadway Paved	98%	98	98

** Estimated % Impervious obtained from Figure C-3 of DRAFT IID Manual*
*** Curve Number obtained from Figure C-2 of DRAFT IID Manual and Table 2-2a in TR-55 (Reference 8)*

4.1.3 TIME OF CONCENTRATION

To generate a hydrograph for small watersheds, less than one square mile, Lag times utilized in SCS methodology are frequently calculated as a function of Time of Concentration (Tc). Time of Concentration (Tc) for each watershed was calculated based on the Time of Concentration Nomograph for the Rational method, using the following formula:

$$\mathbf{Tc = K\,(L^3/H)^{0.2}}$$

Where:

Tc = Time of Concentration (minutes)

K = is a function of % impervious for the basin

L = is the length of the longest flowpath within the basin

H = the elevation change (ΔE) along the longest flowpath.

The K value for each percent impervious was obtained from Appendix II and Figure D-1 in the DRAFT IID Hydrology Manual, and is summarized below.

% Impervious	K
90	0.304
80	0.324
75	0.336
65	0.360
60	0.374
50	0.389
40	0.412
30	0.438
20	0.469
15	0.483
10	0.487
0 (Poor Cover)	0.525
0 (Fair Cover)	0.706
0 (Good Cover)	0.935

4.1.4 LAG

Lag was then computed from the following formula:

Lag = 0.8 Tc / 60

Where:

Lag = is the basin Lag time (hours)

Tc = Time of Concentration (minutes)

The Time of Concentration and Lag calculations were performed in accordance with the Imperial Irrigation District DRAFT Hydrology Manual.

4.2 HEC-HMS PARAMETERS

BASIN MODEL:

Loss Methodology:	SCS Curve Number, with AMC II
Transform:	Standard SCS Unit Hydrograph (Lag)
Channel Routing:	Muskingum-Cunge

METEOROLOGICAL MODEL:

Intensity Position:	2/3 of hydrograph (67%) – equating to approximately hour 16 of a 24-hour storm.
Storms Modeled:	25-year, 24-hr – Precipitation = 2.11 inches 100-year, 24-hr – Precipitation = 2.80 inches "Frequency Storm"

5.0 EXISTING CONDITION HYDROLOGIC MODELING

The existing basin routing for the previously constructed "Seeley Streets Overlay and Drainage Plan" (Reference 9) was compared to the current terrain and watershed delineations. In general, the existing terrain and basin routing corresponded with the previous drainage plan. However, based on the topographic information, the existing routing was slightly different in the following areas:

- Laguna Avenue, between Alamo St. and Rio Vista St.
- Signal Avenue, between Park St. and Main St.
- Haskell Road, between Park St. and Rio Vista St., and between Alamo St. and El Centro St.
- Imperial Avenue between Rio Vista St. and Alamo St
- Evan Hewes Highway between Mt. Signal Avenue and San Diego Avenue, and between Haskell Road and Holt Avenue.

The results of the Existing Condition Hydrologic Modeling, including flowrates and flow paths, are shown on the Existing Condition Hydrologic Exhibit included as Appendix B of this Report and summarize 25-year and 100-year peak flow rates within the townsite.

5.1 EXISTING RETENTION AREAS

The locations of existing retention areas were determined through the use of the existing topography, and survey points of existing structures. The volumes of the above ground retention facilities were calculated from the existing topography, while the volumes of the underground facilities were calculated based on the surveyed pipe size and length between the survey points. The routing in the model was set up so that the runoff tributary to these areas would not contribute to the downstream routing, until the retention volume was full, at which time the flowrate of the runoff exiting the retention area would equal the flow rate of runoff entering the retention area. The existing retention areas have been identified on the Existing Condition Hydrologic Exhibit in Appendix B.

5.2 SURFACE STORAGE

Based on the existing topography within the Seeley townsite area, it was evident that there are localized sump areas where surface storage will occur. In the areas where more significant storage occurs, typically streets and low-lying areas, the volumes were calculated based on the existing topography. The impact of surface storage was incorporated into the hydrologic modeling by allowing these areas to pond and store runoff before contributing the tributary runoff to the downstream routing. The existing surface storage areas have been identified on the Existing Condition Hydrologic Exhibit in Appendix B.

6.0 ULTIMATE CONDITION HYDROLOGIC MODELING

Ultimate Condition hydrologic modeling was prepared to reflect the ultimate planned land uses within the watersheds, as identified in the Imperial County General plan for the Seeley area, including:

- Future roadway improvements reflecting construction of curb and gutter throughout the community,
- Development of currently vacant land, consistent with the general plan land uses in the study area,
- Construction of private retention facilities assumed to be constructed in conjunction with new multiple lot residential developments and on all new commercial and industrial developments areas
- Construction of drainage infrastructure to convey the 25-year storm discharges.

The results of the Ultimate Condition Hydrologic Modeling are shown on the Ultimate Condition Hydrologic Exhibit included as Appendix C of this Report and summarize 25-year and 100-year peak flow rates within the townsite. This exhibit also includes the locations and sizes of the recommended drainage improvements and anticipated retention areas within the study.

6.1 ROADWAY IMPROVEMENTS

Currently minimal curb-and-gutter exists within the study area, and flow is conveyed in roadway swales along the edges of the pavement sections. The ultimate condition hydrologic modeling reflects the construction of curb-and-gutter throughout the Community of Seeley.

The majority of the roadways within the Seeley study area are classified as a “Local Road”, with only a few major roadways classified as “Major Collector” and “Prime Arterial.” Major Collector roadways include Rio Vista Street, and Haskell Road. Drainage Improvements were recommended in locations where the roadway capacity would likely be exceeded in a 25-year storm event.

Hydrologic routing for the ultimate condition hydrologic modeling reflects roadway geometries based on the roadway classifications identified in the Imperial County Engineering Design Guidelines Manual (Reference 3), which are summarized in Table 6.1.1.

6.1.1 TABLE SHOWING PLANNED ROAD CLASSIFICATIONS

Road Classification	Width* (feet)	Curb Height (Inches)
Local Road	40	6
Major Collector	64	6
Prime Arterial	106	6

*Width (ft) represents width of paved road (curb to curb), and does not include right of way.

6.2 RETENTION CRITERIA FOR FUTURE DEVELOPMENTS

Imperial County currently has retention criteria in place for new development projects as cited in Section III-A of the Imperial County Engineering Design Guidelines Manual. For the purposes of this drainage master plan, retention was assumed to be implemented for all new multiple lot residential developments, commercial developments, and industrial developments. However, retention was not assumed on individual residential lots that may currently be vacant but are zoned for use as single-family residential.

Future retention systems are not included in the construction cost estimates, as they are anticipated to remain private systems and not constructed or maintained by Imperial County, but were included in the Ultimate Condition Hydrologic Modeling. Drainage areas where future retention has been accounted for are identified on the Ultimate Condition Hydrologic Exhibit included in Appendix C.

6.3 DRAINAGE INFRASTRUCTURE

Recommended drainage improvements have been identified within the Community of Seeley, with the goal of providing 25-year flood protection for portions of the community where the flow cannot be contained within the road right-of-way, or in areas of public safety concern.

6.3.1 STORM DRAIN DESIGN CRITERIA

The following Criteria were considered when determining the location and sizes of the recommended drainage improvements:

- Minimum Pipe Slopes shall be 0.001 (0.1%) per Imperial County Standards
- Slopes of recommended pipes designed at 0.0015 (0.15%)
- Cleanout Spacing:
  - 300 feet maximum spacing pipes < 48-inches in diameter
  - 500 feet maximum spacing for pipes ≥ 48-inches in diameter
- 30-inches minimum cover depth is required
- Manning's Roughness Coefficient, n = 0.013

6.3.2 STORM DRAIN SIZING

The following table relates the pipe sizes specified for the recommended storm drain facilities along with their respective capacities at their proposed slope of 0.15%.

Pipe Diameter (inches)	Slope (%)	Capacity (cfs)*
24	0.15	7.9
36	0.15	23.2
48	0.15	50.1
60	0.15	90.8
72	0.15	147.6
84	0.15	222.6
96	0.15	317.8

*Capacity based on Manning's Equation with friction slope adjusted to 90% of pipe slope, to reflect assumed hydraulic losses of 10%.

6.3.3 INLET SIZING

The following criteria were considered when determining the minimum number of inlets recommended for each phase of drainage improvements:

- Curb Inlets at a sump condition should be designed for two (2) cfs per lineal foot of opening when headwater may rise to top of curb.
- Curb inlets on a continuous grade should be designed based on the following equation:

$$Q = 0.7L(A+Y)^{3/2}$$

Where:

Y= depth of flow in approach gutter in feet

A = depth of depression of flow line at inlet in feet

L = length of clear opening in feet (maximum 30 feet)

Q = flow in CFS

Detailed Inlet Sizing calculations were not performed for the recommended facilities; however, a minimum number of inlets were assumed associated with the construction of each storm drain segment to intercept the 25-year storm flows. Detailed calculations will be required during final design of any drainage improvements to identify the need for additional storm drain inlets within the drainage system to maintain required flow depth and dry lane requirements within the roadways.

7.0 RECOMMENDED DRAINAGE IMPROVEMENTS

The following summarizes the recommended drainage improvements identified within the Seeley Area Drainage Master Plan study area. Recommended drainage improvements were sized to convey the 25-Year Storm Event. Appendix D of this document serves as a detailed summary of each improvement, including cost estimates and an exhibit showing the limits of the improvement. The location, limits, and costs associated with each phase of the recommended drainage improvement are based on preliminary drainage master plan information. Detailed investigations into potential utility conflicts, right-of-way needs, constructability, and or environmental impacts should be investigated prior to the construction of each project, and may impact the design and/or cost of each project.

7.1 PRIORITIZATION OF IMPROVEMENTS

This DMP anticipates construction of the recommends drainage improvements will occur as a phased approach to improving drainage within the Seeley area. The recommended drainage improvements have been identified as 7 specific phases of construction, or drainage improvement projects. The phase limits are based on providing flood protection benefits with each phase, as well as identifying logical locations for the limits of improvement. The following items were considered when prioritizing the recommended drainage improvements:

- Public Safety,
- Need for downstream improvements prior to implementation,
- Tributary drainage area,
- Property that would be protected by the drainage improvement, and whether it is currently developed or undeveloped.

7.2 CONSTRUCTION COST ESTIMATES

Preliminary opinions of the probable construction costs were prepared for each identified improvement project. The facility quantities and costs presented are preliminary and should only be used for planning purposes. A summary of the assumptions associated with the development of the probable construction costs are included in the Capital Improvement Program Report attached as Appendix D of this DMP.

7.3 TABLE OF RECOMMENDED DRAINAGE IMPROVEMENTS

Project ID	Location	Maximum Q_{25}	Maximum Q_{100}	Pipe Sizes	Total Length	Number of Inlets	Number of Cleanouts	Estimated Cost
SD-01	Rio Vista Street, Haskell Road, San Diego Avenue	220 cfs	319 cfs	36”-84”	4,512 ft	12	15	$7,828,700
SD-02	Rio Vista Street, Imperial Avenue	116 cfs	146 cfs	24”-72”	1,853 ft	8	9	$2,096,700
SD-03	San Diego Avenue, Park Street	54 cfs	77 cfs	36”-48”	1,547 ft	9	6	$1,110,700
SD-04	Rio Vista Street, Holt Avenue, West Main Road, Evan Hewes Highway	72 cfs	106 cfs	36”-60”	1,769 ft	5	8	$1,619,900
SD-05	Holt Avenue, El Centro Street	46 cfs	70 cfs	36”-48”	2,228 ft	8	9	$1,619,500
SD-06	Laguna Avenue	19 cfs	29 cfs	36”	804 ft	4	4	$555,700
SD-07	Evan Hewes Highway	39 cfs	55 cfs	36”-48”	3,477 ft	5	11	$3,210,400

The Projects in this table are listed in the recommended order of priority.
Detailed Descriptions of the Project limits, location, and cost estimates are included in the CIP Report as Appendix D of this report..

8.0 SUMMARY

This report presents a summary of the existing condition and ultimate condition 25-year and 100-year peak discharges within the Community of Seeley, in Imperial County, California. This report also identifies recommended drainage improvements with the goal of providing 25-year storm drain infrastructure within the study area, and alleviating current flooding concerns within the community. Hydrologic calculations were prepared using HEC-HMS, and runoff calculations were performed based on the criteria outlined in the Imperial Irrigation District DRAFT Hydrology Manual.

The recommended drainage improvements identified in this report were prioritized in an order of recommended construction from SD-01 (the first recommended phase) to SD-07 (the final recommended phase). The drainage improvements were prioritized based on the necessity to construct downstream facilities first, and on the public safety issue of reducing flooding first in the areas historically subject to the most flooding and that convey the most water, such as Rio Vista Street.

The results of this Drainage Master Plan report were used to prepare a Capital Improvement Program report, which is attached as Appendix D, summarizing each recommended drainage improvement project, the associated construction cost, and the recommended order of construction.

This report has been prepared for master planning purposes only, as a guide for engineers, planners, developers, and County staff. The recommendations outlined in this report are preliminary and the recommended locations, facility sizes, alignments, and costs should be re-evaluated during final design of each improvement phase.

9.0 REFERENCES

1. *Hydrologic Modeling System HEC-HMS User Manual (CPD-74A),* prepared by The U.S. Army Corps of Engineers, Hydrologic Engineering Center, Version 3.3, September 2008.

2. *Flood Insurance Study for Imperial County, California, and Incorporated Areas,* prepared by the Federal Emergency Management Agency (FEMA), September 26, 2008.

3. *Engineering Design Guidelines Manual for the Preparation and Checking of Street Improvement, Drainage and Grading Plans Within Imperial County, C*ounty of Imperial Department of Public Works, September 15, 2008.

4. *Soil Survey Geographic (SSURGO) database for Imperial County, California, Imperial Valley Area (CA683),* prepared by the U.S. Department of Agriculture, Natural Resources Conservation Service, January 2008, URL:<http://SoilDataMart.nrcs.usda.gov/>

5. *Imperial County Land Use Zoning, Townsite of Seeley, Map 9A,* prepared by Imperial County Planning Department, revised May 11, 2006.

6. *Imperial County General Plan, Seeley Urban Area Map, Figure 1,* prepared by Imperial County Planning Department, revised September 13, 2004.

7. *Imperial Irrigation District, DRAFT Preliminary Drainage Master Plan, Hydrology Manual*, prepared by Black & Veatch, November 1994.

8. *TR-55: Urban Hydrology for Small Watersheds*, prepared by the U.S. Department of Agriculture, Soil Conservation Service, June 1986.

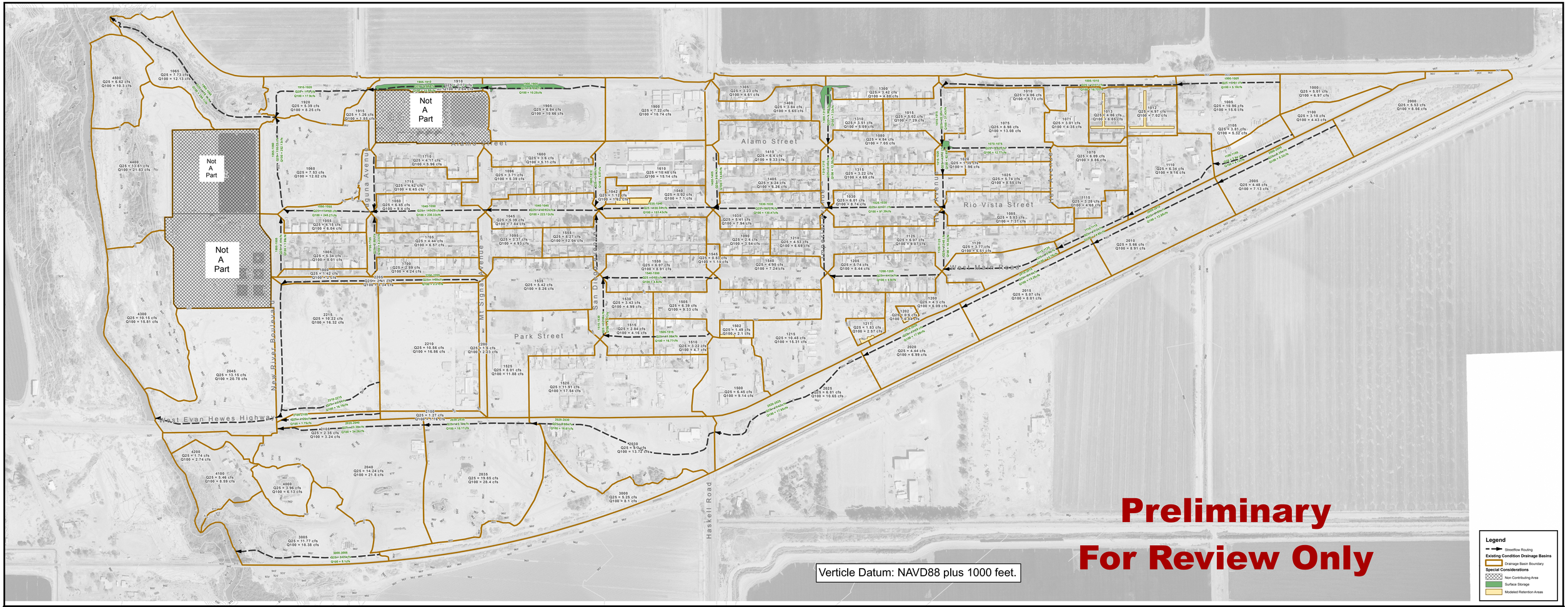
9. *Seeley Streets Overlay and Drainage Plan (M-572),* prepared by the Imperial County Department of Public Works, As-Built May 9, 1979.

APPENDIX A

CD CONTAINING DIGITAL HEC-RAS, GIS, AND CAD FILES.

APPENDIX B

EXISTING CONDITION HYDROLOGIC EXHIBIT



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619.291.0707
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IMPERIAL COUNTY CALIFORNIA

Existing Condition Hydrologic Exhibit

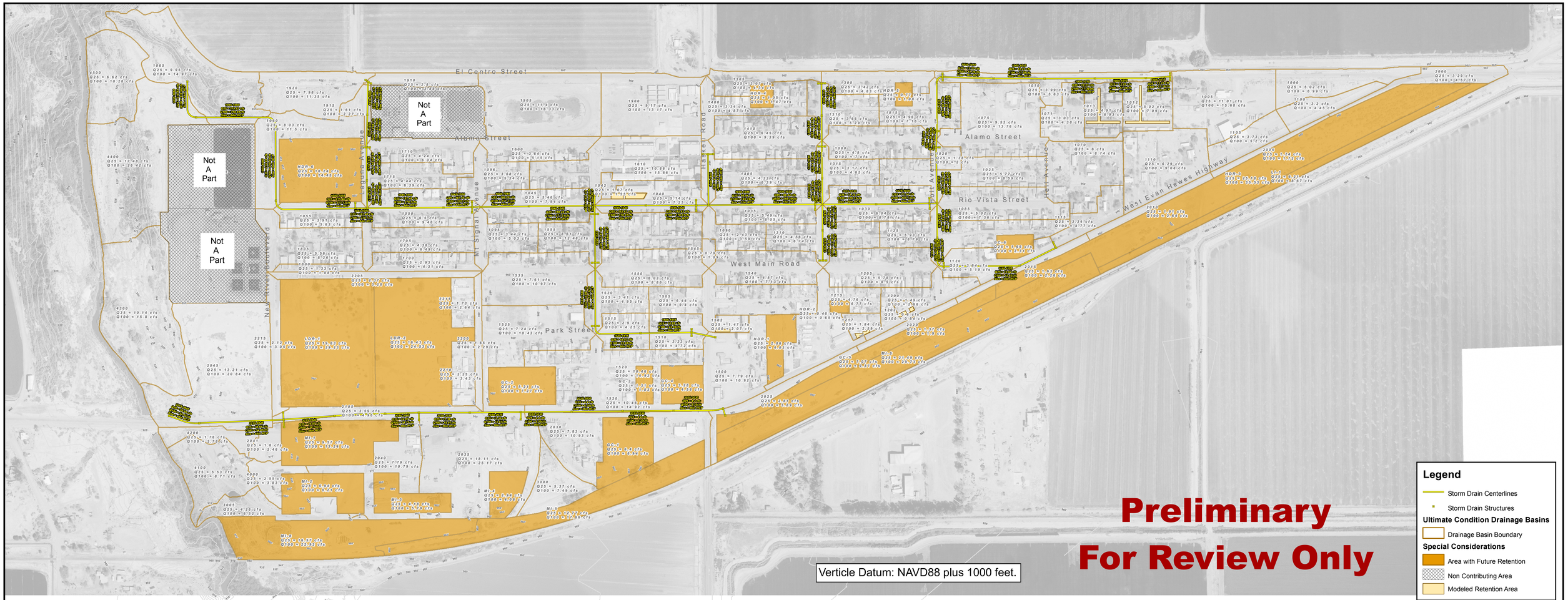
W:\16101\Hydro\Seeley_Basins_Map.mxd
Exhibit Date: March 2010
REC JN: 16101

200 100 0 200 400 Feet

NORTH

APPENDIX C

ULTIMATE CONDITION HYDROLOGIC EXHIBIT



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Ultimate Condition Hydrologic Exhibit

W:\16101\Hydro\Seeley_Basins_Map_ultimate.mxd
Exhibit Date: March 2010
REC JN: 16101

200 100 0 200 400 Feet

NORTH

APPENDIX E

TOPOGRAPHIC MAP

SEELEY
0
100
200
300
GRAPHIC SCALE. 1"=150'
N
COMPILED BY PHOTOGRAMMETRIC METHODS
JOB NUMBER: 16101
DATE OF SURVEY: 03/24/2009
DATE OF PHOTOGRAPHY: 03/24/2009 TYPE: B/W
CONTOUR INTERVAL: 1 FT. APPROX. PHOTO SCALE: 1"=300'
BASIS OF COORDS: NGS MON. "F 612"
BASIS OF ELEV: NGS BM "M 59"
HORIZONTAL DATUM: NAD83, CCS ZONE 6, 2007.0 EPOCH
VERTICAL DATUM: NAVD88 PLUS 1000 FEET
EXCEPT CONTROL VALUES
MAP BOUNDARY
RETAINING WALL
MASONRY WALL
FENCE GENERAL
ASPHALT EDGE
CONCRETE EDGE
DIRT ROAD
CURB
BRIDGE
RAILROAD SINGLE
MARINA DOCKS
TANK
MISC UTILITIES
HEADWALL
WATER LINE
ASPHALT DRAIN
CONCRETE CHANNEL
BUILDING
POOL/SPA
PATIO/SHELTER
TRAILER
CONVEYOR
TREE LINE
BRUSH LINE
TREE LINE CIRCLE
PILE
INDEX CONTOUR
INTERM CONTOUR
DASH INDEX CONT
DASH INTERM CONT
DEP INDEX CONT
DEP INTERM CONT
DASH DEP IND CON
DASH DEP INTERM
HARD BREAK
DASH TREE CON
NORTH ARROW
Undefined
HORIZ/VERT CONTR
GRIDTICK
STREET LIGHT
TRAFFIC SIGNAL
RAIL ROAD SWITCH
POWER POLE
X SPOT ELEVATION
E 6,739,000
E 6,739,500