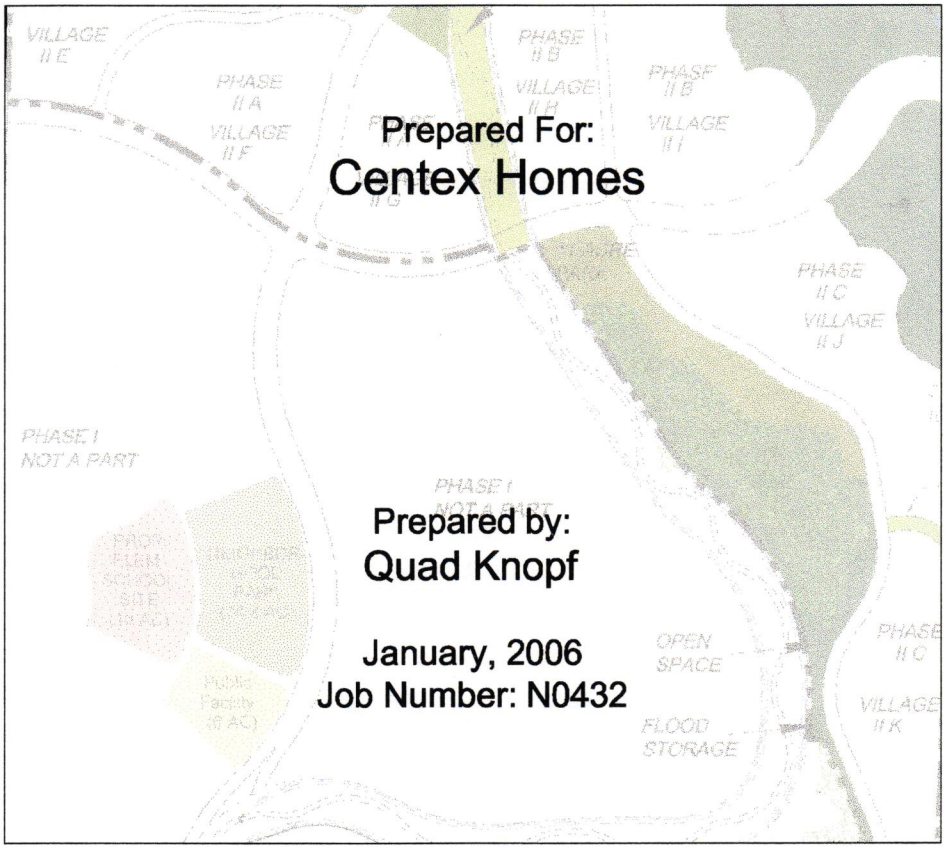
FLOOD CONTROL MASTER PLAN
BELLA VISTA RANCH
PHASE II

City of Reno, Nevada



Quad Knopf

9600 Prototype Ct.
Reno, Nevada 89521
TEL: (775) 324-1212
FAX: (775) 324-2311
WEB: www.quadknopf.com

PROFESSIONAL ENGINEER STATE OF NEVADA
RALPH M. HOGOBOOM
Exp 6-30-07
CIVIL
No. 11813

1-13-06

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PHASE 2

FLOOD CONTROL MASTER PLAN

SOUTHERN PORTION OF THE BELLA VISTA RANCH

1.0 INTRODUCTION

The original Master Plan Document was prepared for Phase 1 and Phase 2 of Bella Vista Ranch Subdivision. However the two phases were separated for submittal at different times. The original document " FLOOD CONTROL MASTER PLAN, BELLA VISTA RANCH, City of Reno, Nevada" dated June 3, 2005 prepared by Quad Knopf was submitted with Phase 1.

Phase 1 plans are currently in the review process in the City of Reno. They include the majority of the Relocated Steamboat Creek, all of the east-west channel and the westerly channel. Phase 2 includes the construction of the northerly 1500 feet of Relocated Steamboat Creek and the construction of a multi-barrel box culvert at the proposed South Meadows Parkway crossing. Existing drainage courses from the lower portions of the Virginia Range foothills have been delineated.

1.1 Background

The majority of the Bella Vista Ranch lies within a broad alluvial valley in the southern portion of the Truckee Meadows. A small portion of the property on the easterly boundary is situated on the lower portion of the Virginia Range. Properties to the south, the Damonte Ranch, and the west, the Double Diamond Ranch, are undergoing intensive master planned development. The drainage and flood control infrastructure which has been constructed with these two large developments was master planned with area wide considerations. See Figure 1.

1.2 Damonte Ranch Facilities

The facilities constructed on the Damonte Ranch have the largest impact upon the planning for drainage and flood prevention for the Bella Vista. Steamboat Creek, Whites Creek Branches 3 and 4 and the Eastside Tributaries (flows from the Virginia Range) have been (or will at ultimate build out be) collected in a series of natural and engineered channels which were designed to maintain the drainage patterns which existed prior to development.

The Steamboat Creek channel loses capacity at a point north of the Whites Creek Branch 3 channel and a diversion structure has been built to allow the lower flows to continue north in the current channel and to capture the higher flows and to direct them over a side weir and into a series of large regional detention facilities. The large detention facilities also serve as wetlands mitigation areas. Those excess flows, along with the onsite flows and flows entering from the eastern boundary are directed toward the Steamboat Creek historic channel on the eastern portion of the project. They sheet flow through regulatory wetlands areas and areas set aside for future wetlands mitigation.

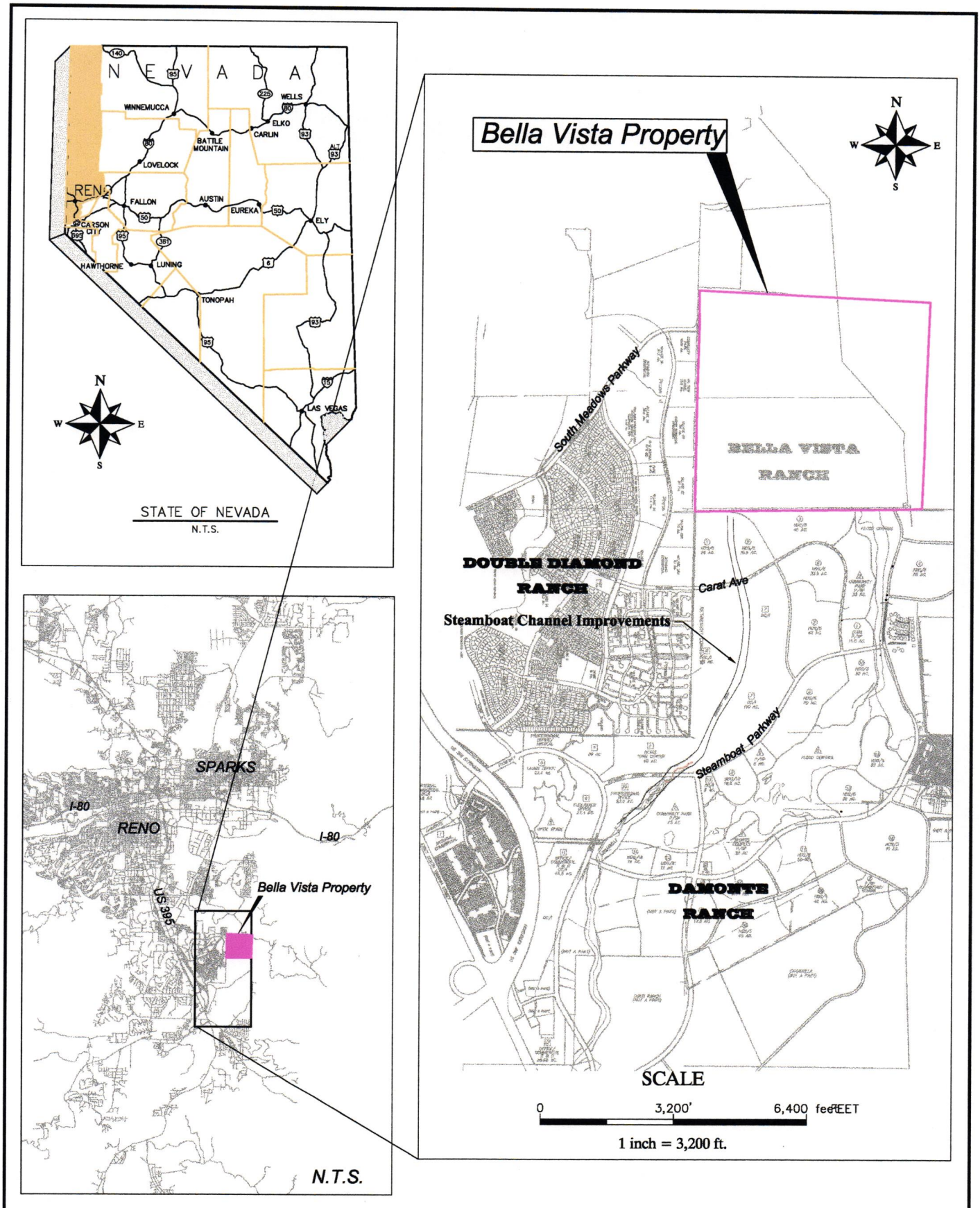

Figure 1

Vicinity Map
Bella Vista Ranch

Centex Homes

Quad Knopf Job #: N0432
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Reno, Nevada 89521
TEL: (775) 324-1212
FAX: (775) 324-2311
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Phased construction of the Damonte Ranch has begun on the central and southern portion of the property. Construction of the Relocated Steamboat Creek is nearing completion through the northerly portion of the property. The channel has been excavated and the majority of the rockery walls have been constructed. The major construction remaining is the construction of two multi-barrel reinforced concrete box culverts. The Steamboat Creek flows are returned to sheet flow and combine near the northern boundary of the ranch. When the final phases of the project are built and agreements are reached with the Bella Vista development, the flows will be confined to the restored Steamboat Creek channel, a channel on the west side of the project and to the wetlands mitigation site on the east.

1.3 Double Diamond Ranch

Flood control facilities on the Double Diamond Ranch include the confinement of Thomas Creek to wetland areas and designed channels. These channels deliver the 100 year flows to the Double Diamond regional detention basin on the northern portion of the east boundary of the project. Whites Creek Branches 1 and 2 are also conveyed through the Double Diamond project in a series of channels and wetlands and combine with the Thomas Creek flows to be conveyed to the regional detention basin. On site flows are collected primarily in the Central Channel and in a channel on the eastern boundary of Double Diamond. The Central Channel combines with the Thomas and Whites Creek and flows into the detention basin. The flows in the channel on the eastern boundary are also conveyed to the regional detention basin. This channel was also sized for flows which were displaced by the placement of fill on the eastern edge of the Double Diamond ranch.

2.0 BELLA VISTA PROJECT SITE

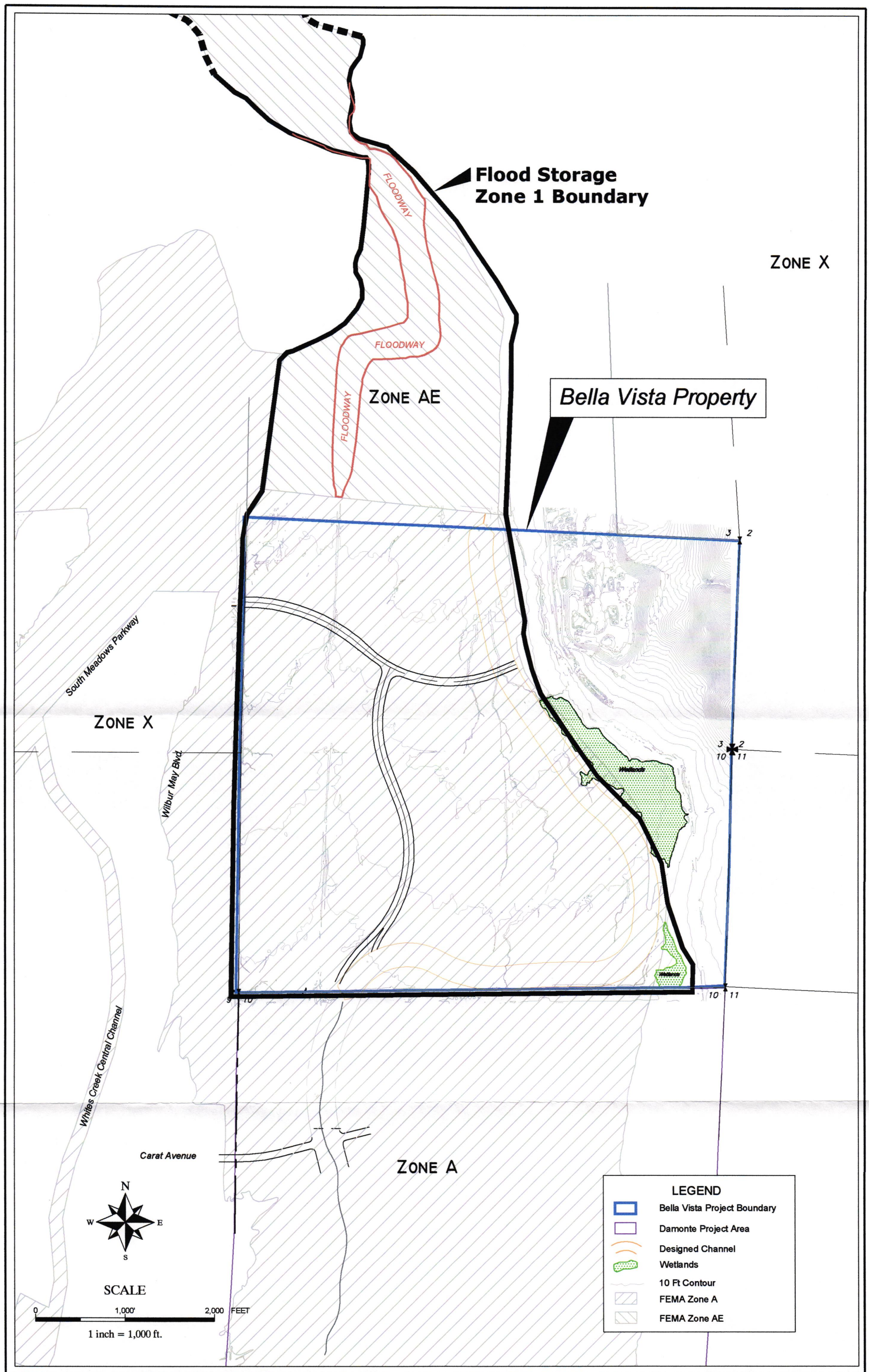
The Bella Vista Ranch has been determined to be subject to flooding in a 100 year or 1% chance flood. It is within an unnumbered Zone A and Zone AE on Panel 3178 of the Flood Insurance Rate Map for Washoe County and Incorporated Areas, effective date of September 30, 1994. It is affected by two sources of flooding as described in the following sections. The flood zones are shown on Figure 2.

2.1 Steamboat Creek

Steamboat Creek is the major source of flooding on the Bella Vista parcel. The creek was diverted from its natural channel more than a century ago with the advent of ranching and farming in the Truckee Meadows area. The low flows were diverted to a perched channel which was constructed in a north south alignment. This alteration allowed for flood irrigation of the Bella Vista. In larger events, the flows which exceed the channel capacity break out of the manmade channel and flow primarily eastward to the historic channel. Most of the ranch is covered with sheet flow during a major event, with the manmade and historic channels having the deepest flows.

2.2 East Side – Virginia Range Tributaries

No significantly large basins affect the parcel from the eastern boundary but there are three basins whose 100 year discharges range from 38 to 135 cfs. Flows from these basins are most likely to be more hazardous during localized thunderstorm events rather than during a general rain event.



Sheet 1 of 1	FIGURE 2	Scale: 1" = 1,000'	*Revisions:*	9600 Prototype Ct. Reno, Nevada 89521 TEL: (775) 324-1212 FAX: (775) 324-2311 WEB: www.quadknopf.com
Quad Knopf Job # N0432	Existing Conditions FEMA Zone Map	CI: detailed contours = 10 Feet		Quad Knopf N0432
Date: Jan 2006	*Centex Homes*	File Name: 0432_Figs2,3,9.dwg		
	Washoe County *Nevada*	Drawn By: GH		
		Designed By: PB		

3.0 FLOOD CONTROL MASTER PLAN GOALS AND INTENT

The Flood Control Master Plan for the Bella Vista Ranch has as one of its primary goals to provide flood protection for the proposed project and to adhere to the floodplain management ordinances of the City of Reno and the Interim Policies adopted by the Regional Water Planning Commission. Channel and storm drain design will be in accordance with the *City of Reno Design Standards* and the *Draft Hydrologic Criteria and Drainage Design Manual.*

The improved Steamboat Creek which is being restored with this project close to its historic alignment, as preferred by the *Steamboat Creek Restoration Plan*, will provide the central feature of the plan. The current channel has basically been used as an irrigation canal and does little to further the goals proposed by the restoration plan, especially the reduction of the total dissolved solids in the flow. A low flow channel as described above is incorporated into the design as recommended in the *Steamboat Creek Restoration Plan.* The main channel is proposed with a sinuous channel to avoid decreasing the time of the peak flow through the project and to prevent increasing its quantity.

The major wetlands adjacent to the channel will provide overflow capacity for extreme events and flood storage capacity for the project. The project lies within zone 1 of the critical flood storage zones for the Truckee River Watershed, however it is not within the backwater pool caused by the Huffaker Narrows and its culvert structure, nor the proposed flood pool of the conceptual detention dam proposed by the Corps of Engineers Truckee Meadows Flood Management Project.

3.1 Purpose of Master Plan

This Master Plan was developed in order to provide a framework for final design of the drainage and flood control features of the Bella Vista Ranch development The framework will

- Quantify flows originating off site and on site
- Provide conceptual or preliminary design for channels and other hydraulic structures
- Propose mitigation for any impacts to adjacent property owners
- Provide sufficient analyses to support the facilities proposed.

Further, more detailed analyses and studies are planned during various stages of the project design. Specifically:

- Hydraulic evaluation of the proposed Steamboat Creek restoration channel and certification that the Master Grading and Major Infrastructure Plan for Phase I is in conformance with this Master Flood Control Plan. This evaluation will be submitted with the construction drawings for the channel and will present any

analyses needed for proposed variations. This report will also include the final Flood Storage Plan.

- Application for Conditional Letter of Map Revision to FEMA for confirmation that the facilities proposed are in conformance with FEMA policies and that the project will be removed from 100 year floodplain when built as designed
- Hydrology Reports for each tentative map
- Hydrologic and Hydraulic Evaluation for Phase II Grading and Drainage Plan

3.2 Flood Storage Zone 1

The Bella Vista Ranch lies within critical zone one as delineated by the Regional Water Planning Commission and adopted by the City of Reno. The purpose of the zone 1 designation was to assure that properties that are developed do not affect the proposed Truckee Meadows Flood Management Plan as developed by the Community Coalition. This plan relies upon the preservation of the volume of flood ponding currently available in the eastern Truckee Meadows. Projects must mitigate development within the ponding areas by providing storage in a hydraulically connected area or by participating in a regional project.

The southern portion of the Bella Vista does not contain ponding areas, only shallow sheet flow, so it is difficult to offer mitigation in the spirit of the current ordinance, that is, no ponding areas are proposed to be eliminated. Critical areas on the Bella Vista Ranch are those north of the project which lie within the proposed flood pool of the Huffaker Hills Detention Basin, a part of the flood management plan. The extent of this proposed detention structure's flood pool is shown on figure 3. The flood pool is based upon the current elevation of the spillway at 4428.

A second alternative to the Huffaker Hills Detention Basin is under study by the Corps of Engineers and the local project sponsors. This alternative has a spillway design of 4448 and would inundate the entire project. This concept would require levees of more than 20 feet adjacent to the South Meadows Business Park, render the Double Diamond Detention Basin useless and require large pumping stations to remove drainage and flood waters from both the Double Diamond Ranch and the South Meadows Business Park. It is highly unlikely that this alternative will be pursued due to serious objections from the City of Reno and affected residents and the extraordinary cost of such an undertaking.

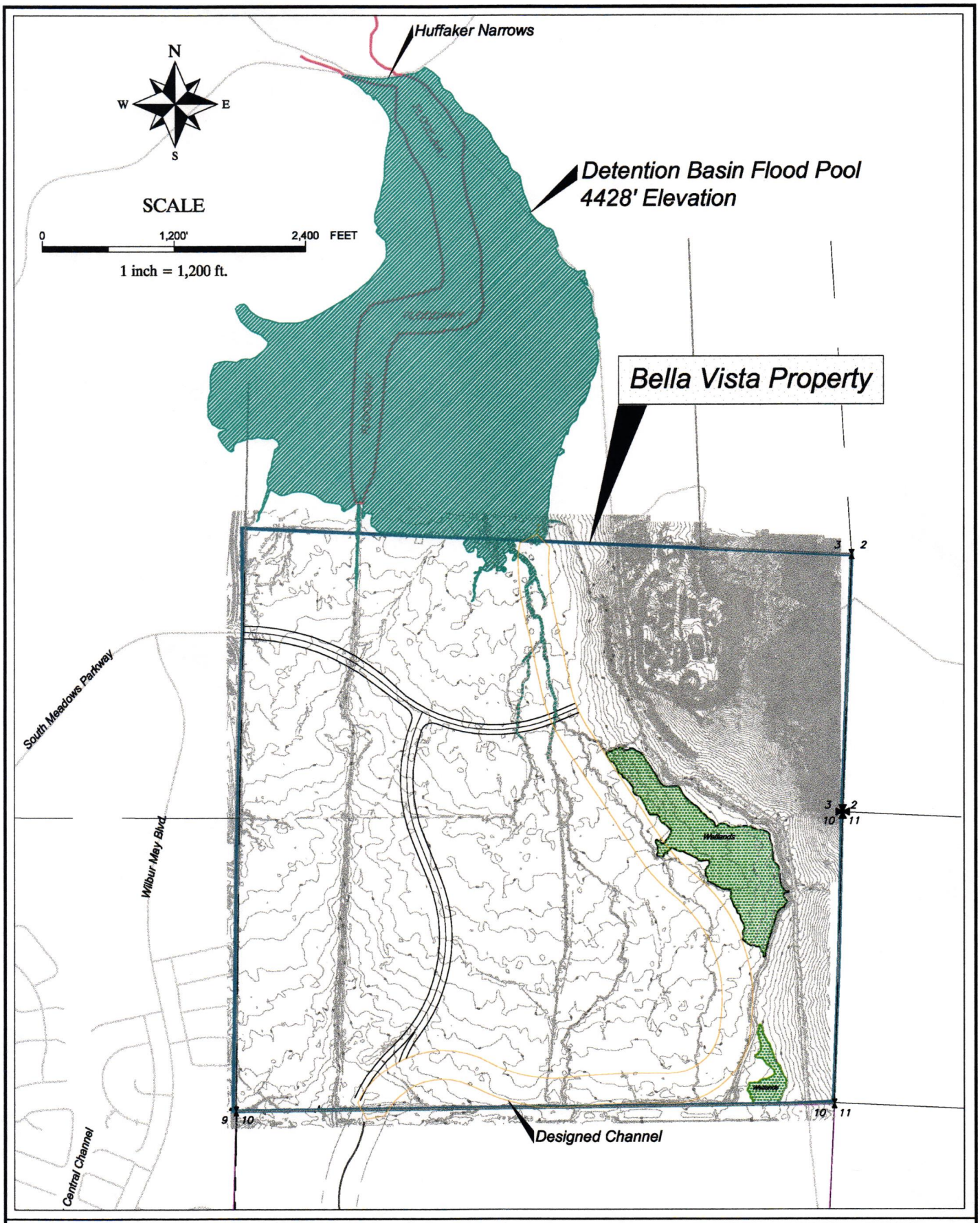


Figure 3

Detention Basin Flood Pool

Bella Vista Ranch

Centex Homes

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Care has been taken in the concept development of flood control and drainage features to avoid adverse impacts on the flood storage capacity downstream of the project. The relocated Steamboat Creek channel is designed for minimal velocities and a longer travel time in order to minimize or negate any impacts to the hydrograph (especially the timing of flows) at the Huffaker Narrows.

The construction of impervious surfaces within the development will increase the *volume* of runoff. The mitigation of this increase in runoff is to take place in the following way:

> On site mitigation both phases can be achieved by retention in the two parcels shown on Figure 4 and the volume of stormwater which leaves the property will remain at pre-development levels during the 100 year design event (as determined by the Truckee Meadows Flood Management Project). This mitigation includes full retention until the peak volumes of flood flows have receded in the Vista area. The release from the oversized basins will be designed to retain the required volume for a 72-hour period following the peak of the storm. The suggested design of the outlet structures is included in the Plans for Phase 1 currently being reviewed by the City of Reno. Our calculations based upon the conceptual land plan show that about 20 acre-feet of storage for Phase 1 and 4 acre-feet of storage for Phase 2 will be needed for mitigation of the project at its currently proposed density. Full retention areas of the property have been set aside to contain the estimated volume and are shown on figure 3.

The drainages from the east side tributaries will be intercepted in their current configurations by the improved Steamboat Channel. Onsite flow which is generated on Phase 2 is confined to areas north of South Meadows Parkway and east of the improved Steamboat Channel. The concentrated flows from the improved Steamboat Channel will also enter the property to the north in a manner to be determined by agreement between the project developer and the land owner. These concepts are being reviewed and analyzed and will be finalized in detail in the Hydraulic Report which will be prepared for the channel design and the Master Grading and Major Infrastructure Plan discussed earlier in this report.

3.3 Development Phasing Plan

Phase 2 of the project is shown on Figure 4. The northerly 1500 feet of Steamboat Channel will be constructed and the South Meadows Parkway crossing are to be completed as part of the Phase 2. The required flood storage for Phase 2 will be near the northerly boundary line.

BELLA VISTA PROJECT BOUNDARY

2 ACRE FLOOD STORAGE

STEAMBOAT CREEK RESTORATION EXTENSION

FIRE STATION 2.5 ACRES

OPEN SPACE

WATER SITE

PHASE II A

VILLAGE II E

PHASE II A

VILLAGE II F

PHASE II A

VILLAGE II G

PHASE II B

VILLAGE II H

PHASE II B

VILLAGE II I

STEAMBOAT CREEK CHANNEL

Phase 2 Development

11 ACRE PARK

PHASE II C

VILLAGE II J

WESTERN CHANNEL

PHASE I NOT A PART

Phase 2 Development

PHASE I NOT A PART

WETLANDS

PROP. ELEM. SCHOOL SITE (10 AC)

NEIGHBOR-HOOD PARK (14.8 AC)

Public Facility (6 AC)

Flood Storage Approx. 2.7 ac

OPEN SPACE

PHASE II C

VILLAGE II K

FLOOD STORAGE

WETLANDS

Flood Storage Approx. 4.8 ac

DAMONTE RANCH PHASE 5

LEGEND

- Bella Vista Project Phase 1 & 2
- Phase 2 Boundary
- Designed Channel
- Flood Storage Area

N

W E

S

SCALE

0 600' 1200' FEET

1 inch = 600 ft.

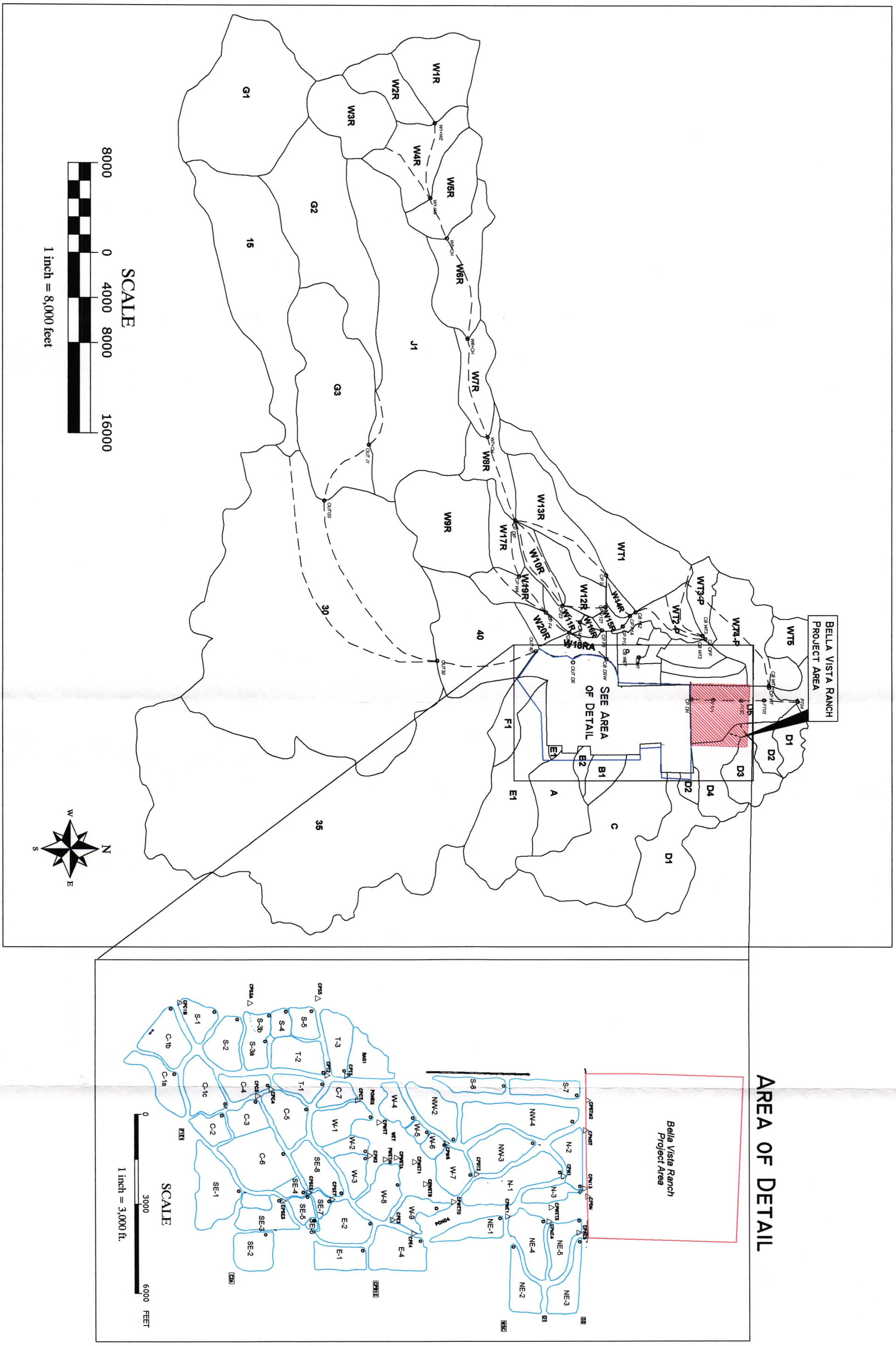
Sheet 1 of 1 Quad Knopf Job: N0432 Date: May, 2005	FIGURE 4 Phasing and Flood Storage Areas *Centex Homes, Inc.* *Reno* *Nevada*	Scale: 1" = 600' CI: NA File Name: 0432_Figs-Cov,4,6,8.dwg Drawn By: GH Designed By: DW	*Revisions:*	Quad Knopf 9600 Prototype Ct. Reno, Nevada 89521 TEL: (775) 324-1212 FAX: (775) 324-2311 WEB: www.quadknopf.com N0432

4.0 HYDROLOGIC ANALYSES

Hydrologic analyses for the flood control concept development for the Bella Vista Ranch Project were performed using the Army Corps of Engineers HEC 1 program and the approved master plans for the Damonte and Double Diamond Projects. The hydrologic models for these projects were developed by Nimbus Engineers using locally accepted parameters and are the basis of the flood control infrastructure which has been constructed upstream of the project and for the future improvements which are planned. These models are the current effective FEMA models, which were approved by the City of Reno and Washoe County and submitted to and approved by FEMA, with a number of CLOMRs and LOMRs for the two developments. The results of the models prepared for the preliminary designs are included on a CD in Appendix A of this report. Figure 5 is the hydrologic work map which displays the regional basin configuration used in the model.

Steamboat Creek entering the Bella Vista site from the south currently sheet flows from the south to the north contributing 5972 cfs. North of the property line, after combining with the flows from the Double Diamond Regional Detention Basin and the east side tributaries the flow is 6362 cfs. Upon the completion of the Damonte Ranch improvements at the south property line 4213cfs will enter through the channel on the western side of the property and 2836cfs will enter through the confined wetlands flow on the eastern portion of the project. For further discussion of the improvements which have been constructed to date on the Damonte Ranch the reader is referred to *Application for Letter of Map Revision for the Double Diamond and Damonte Ranch Regional Flood Control Improvements,* Nimbus Engineers, 2004. For further discussion of the future conditions the reader is referred to *Application for Conditional Letter of Map Revision Damonte/Double Diamond Ranch for Regional Flood Control Improvements,* Nimbus Engineers, 2001.

The Bella Vista Ranch on site flows will increase with the type of development planned. The impact of the increased on-site flows has been assessed using street patterns and site grading plans developed by Places Consulting. Most of those on-site flows will be directed to the restored Steamboat Channel, with lesser amounts being directed to the westerly boundary to the West Side channel. In the central portion of the project, the East West channel will collect flows and direct them to the Steamboat Creek channel. The Steamboat Channel is proposed as a restoration channel and will include features for wetland enhancement and mitigation, as well as water quality improvement, which have been designed in consultation with the Corps of Engineers.



Sheet 1 of 1	FIGURE 5 REGIONAL WATERSHED MAP Bella Vista Ranch *Centex Homes* *Reno* *Nevada*	Scale: 1" = 8000' & 1" = 3000' (inset)	References:
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January, 2006		File: 0432_Fig5_Reg-Sheds.dwg	
		Drawn By: GH	
		Designed By: PB	

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FAX: (775) 324-2311
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The hydrologic analyses for the Bella Vista Ranch, as noted earlier, have been performed using the Corps of Engineers HEC 1 computer program and current effective models accepted by FEMA. The analyses enclosed are as it is on the ground today, sheetflooding from the south. Also included is an analysis which assumes that the Damonte Ranch Phase V improvements have been approved and built and that Steamboat Creek is contained when it enters the site and the Phase 1 improvements for Bella Vista have been approved and built.

The following table includes descriptions of the models and their file names. These models are included in electronic form on a CD in Appendix A .

Table 1

Regional Models		Peak flow
0243AB.dat	-Existing Conditions	6362
DRph5.dat	- Existing conditions w/ Damonte V	7165
DRph5+BV1.dat	-Post-development (through Phase 1)	7022
DRph5+BV2.dat	-Post-development (through Phase 2)	7057

Onsite Volume Models:		Volume
BV72UND.dat	-Existing conditions	101 ac-ft
BV72DEV1.dat	-Post-development (through Phase1)	121 ac-ft
BV72DEV2.dat	-Post-development (through Phase 2)	125 ac-ft

4.1 On-site Hydrologic Analysis

Earlier discussion in this document focused on the overall development. Figures 6,7, and 8 show the project layout and the sub-watersheds used in the on-site analysis, the configuration of the Damonte V project used in this analysis and the soils map used to develop the curve numbers for the analysis. The on site hydrologic analysis was performed using the Corps of Engineers HEC-1 computer program. On-site basins generally drain to the relocated Steamboat channel. Table 2 sets forth the parameters which were used in the HEC-1 model; times of concentration were determined to be the minimum (10 minutes) based upon the formulas in the *Hydrologic Criteria and Drainage Design Manual*, therefore they are not listed.

Double Diamond
Detention Basin

(1,030 feet from Bella Vista Property Boundary)

BELLA VISTA PROJECT BOUNDARY

DR-1

DR-2

DR-3

DR-4

DR-5

DR-6

DR-7

BVW-1

BVW-3

BVW-5

BVW-6

BVW-7

BVW-8

BV-1

BV-2

BV-3

BV-4

BV-5

BV-6

BV-7

BV-8

BV-9

BV-10

BV-11

BV-12

BV-13

BV-14

BV-15

BV-16

Phase 2 Development

Phase 2 Development

STEAMBOAT CREEK CHANNEL

WESTERN CHANNEL

EAST-WEST CHANNEL

DAMONTE RANCH PHASE 5

N

W E

S

SCALE

0 600' 1200' FEET

1 inch = 600 ft.

LEGEND

- Bella Vista Project Phase 1 & 2
- Phase 2 Boundary
- BV-2 — Onsite Watershed
- Designed Channel
- Flow Direction

Sheet 1 of 1	FIGURE 6 Onsite Hydrologic Workmap *Centex Homes, Inc.* *Reno* *Nevada*	Scale: 1" = 600'	*Revisions:*
Quad Knopf Job: N0432		CI: NA	
Date: Jan. 2006		File Name: 0432_Figs-Cov,4,6,8.dwg	
		Drawn By: GH	
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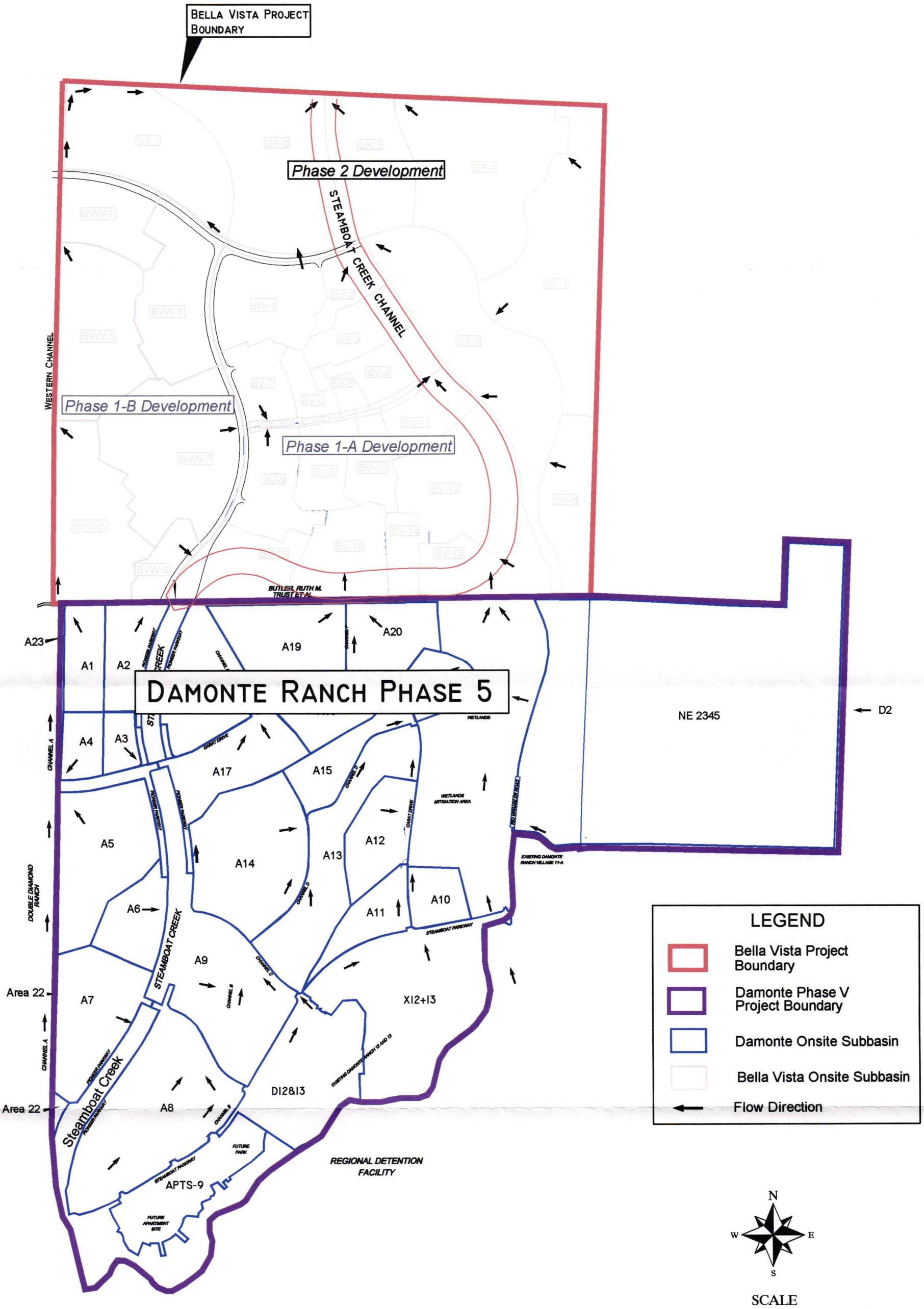

Sheet 1 of 1	FIGURE 7 Damonte Onsite Subbasin Map Bella Vista Ranch *Centex Homes* *Reno* *Nevada*	Scale: 1" = 1,000'	*Revisions:*	Quad Knopf 9600 Prototype Ct. Reno, Nevada 89521 TEL: (775) 324-1212 FAX: (775) 324-2311 WEB: www.quadknopf.com
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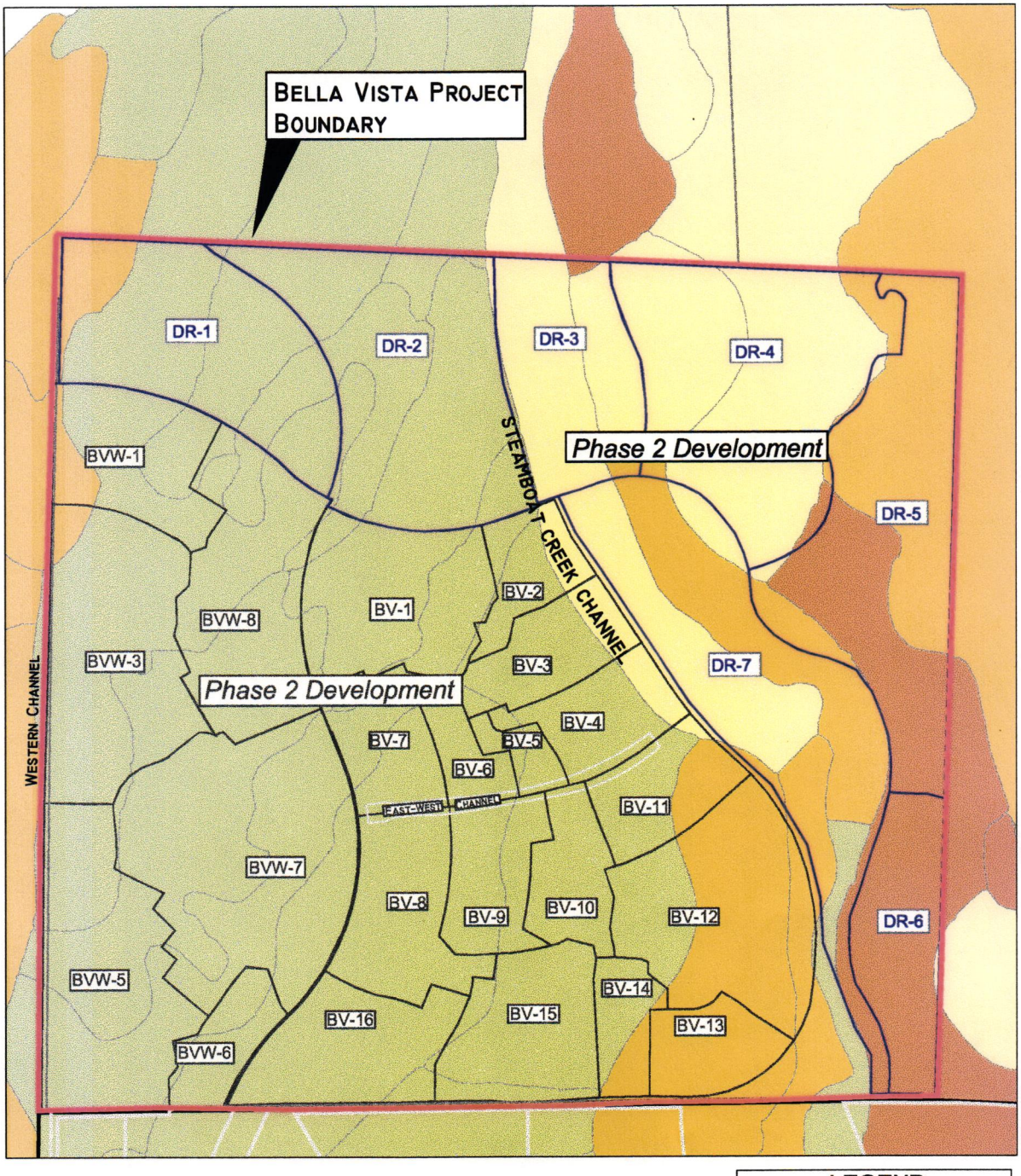

LEGEND

- Project Boundary
- BV-2 Onsite Watershed

Soil Hydrologic Groups

- Group A
- Group B
- Group C
- Group D

N

W E

S

SCALE

0 1000' 2000 FEET

1 inch = 1000 ft.

Figure 8
Soils Map
Bella Vista Phase 1 & 2

Centex Homes

Date: Jan 2006

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File: 0432_Figs-Cov,4,6,8.dwg

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Table 2 On-site Watershed Parameters

Sub-basin ID	Area (acres)	Area (mi^2)	CN Pre-Development	CN Post-Development
DR-1	33.92	0.053	74	86
DR-2	26.24	0.041	74	90
DR-3	18.56	0.029	74	90
DR-4	44.80	0.070	74	75
DR-5	65.92	0.103	74	78
DR-6	18.56	0.029	74	87
DR-7	61.44	0.096	74	49

Modeling for existing conditions, as presented in the effective FEMA models, produces a flow of 6362 cfs at the north end of the Bella Vista Ranch Project when the onsite flows are combined with the 5972 cfs sheet flow coming from the Damonte Ranch Project. Damonte Ranch V is proposed to channelize Steamboat Creek and the Westside Channel to the Bella Vista Ranch south property line. With that development the flows entering Bella Vista will be 4213cfs in the channel and 2836cfs from the confined wetland flow on the eastern side of the property.

This modeling is presented to demonstrate the impacts of the development which will need to be mitigated, either because of increase in peak flows which would require detention, or increase in the volume of runoff which will require flood storage to be developed. An area within the development have been reserved for flood storage and/or peak flow detention. The increase in peak flows from the on-site development are approximately 44 cfs, considering only Phase 1 and 2 developments. The increase in on site peak flows however does not increase the overall peak flow leaving the project. If the increase in on site peak flow is detained, it will add to the off site peak flows which enter and leave the site after the runoff from the on site basins and the peak at the Huffaker Narrows will be increased. Increase in the volume of flow will be mitigated and this volume mitigation will also serve as detention. The final design of the flood storage will be incorporated into the channel design and be submitted in conjunction with the Master Grading and Major Infrastructure Plan.

5.0 HYDRAULIC ANALYSES

A HEC RAS model has been developed of the proposed relocation of Steamboat Creek in order to demonstrate that the channel is physically feasible and that the velocities will remain low enough to achieve the goals of improved riparian vegetation and wetlands enhancement. The model will be refined and updated as final design plans are developed to incorporate freeboard requirements and to include storm drainage inlets and confluence configurations for the east side tributaries and flows entering in the southwest

corner from the Damonte wetlands flows. Figure 9 shows the channel alignment and cross section location for the RAS analysis. HEC-RAS analysis for the existing natural channels in the East side is included. Preliminary designs of these channels for developed conditions are also provided.

5.1 Hydraulic Analysis of the Steamboat Creek channel

The channel that is proposed for Steamboat Creek is compatible with the goals of the Steamboat Creek restoration plan and has been developed in consultation with the U.S. Army Corps of Engineers and the wetland scientists for the project. The channel will convey the western flows to the east to combine with the flows from the Damonte wetlands and then continue to the north in the alignment of the historic Steamboat Creek channel. The Phase 1 portion of the channel slope varies from 0.0016 to 0.0018 ft/ft. Phase 2 will continue downstream with a channel slope of .0016 ft/ft and have a water surface top width of approximately 240 ft. All velocities calculated are non-erosive.

A low flow channel is incorporated into the preliminary design. See typical section on Figure 9. The channel has a capacity of approximately 25 to 30 cfs. This low flow channel has been sized and configured as requested by the Corps of Engineers during review of the 404 Permit application for channel relocation. The final low flow design will incorporate point bars which are periodically flooded to enhance the wetland mitigation. These enhancements to the low flow channel do not affect the performance of the larger channel and are not analyzed herein. The Corps of Engineers preferred depth for the channel will make it extremely likely that the channel will be constructed in some portions of the ground water. Consultation with the Nevada Department of Environmental Protection has been done. The department has no current objection to the channel intercepting groundwater flow. It is felt that any effects to the water table will be localized and will be similar to the effect of the current Steamboat channel. Soil testing within the proposed alignment of the channel is currently underway and soil and water samples will be tested.

The restored Steamboat Channel has been designed to connect to the channel proposed for the Damonte V development. As noted earlier, the preliminary design has been developed in consultation with the project's wetlands consultant and the Corps of Engineers Reno Office. The alignment and cross sections of the channel are in conformance with the Steamboat Creek Restoration Plan which is the locally accepted and preferred standard for improvements to the Creek and its associated floodplains. The preliminary design presented here has been submitted to the Corps of Engineers as the basis of a request for a 404 Permit from the Corps which is required under the Clean Water Act.

A Corps of Engineers HEC RAS model was prepared for the channel design and is included in Appendix A. The model was developed with generally accepted parameters for an earthen channel. The designed channel will not have velocities which exceed 5 feet per second and the curvature of the channel conforms to standards set forth in the

Hydrologic Criteria and Drainage Design Manual. The final design of the channel will be developed in conjunction with the Master Grading Plan in order to assure that the channel has proper freeboard.

The preliminary design of the channel shown in this report, presumes that the Damonte V channel Bella Vista Phase 2 portion of the channel will be built prior to the Bella Vista Phase 2 portion of the channel. If the Damonte channel is not built in a timely manner, the design of the Bella Vista channel will be modified to include the capture of the sheet flow which exists in that area presently. Site specific surveying is being obtained in order to develop the spreading structure which will be needed at the channel outlet. The design for that structure will be included in the Hydraulic Analysis report for the channel.

5.2 East Side Channels

HEC-RAS analysis for the existing natural channels in the East side is included (see Appendix B). Preliminary designs of these channels for developed conditions have been developed based upon analysis of channel size and velocity using the Manning Equation (see Table 3). Loose rip-rap lined channel is used. Location and cross section of these channels are given in Figure 10.

Table 3 Preliminary Design of East Side Channels (Developed Conditions)

Channel Name	Discharge	Manning's n	Longitudinal Slope	Side slope	Bottom Width	Flow Depth
	(cfs)		(ft/ft)		(ft)	(ft)
South Channel	91	0.04	0.03	2H:1V	6	1.51
Mid Channel	10	0.04	0.03	2H:1V	2	0.73
Far North Channel	138	0.04	0.05	2H:1V	10	1.29

6.0 CONCLUSIONS AND RECOMMENDATIONS

The Bella Vista Ranch project will create a project which is compatible with surrounding developments and will meet all requirements for the safe handling of drainage and flood flows as set forth in City ordinance and standards. The analyses which are provided herein have been developed to provide a framework for orderly development of the project and for the design of the needed drainage and flood control features. The submittal of an Application for a Conditional Letter of Map Revision (CLOMR) will be prepared after approval of the Master Plan. The approval of the CLOMR by FEMA will assure that the project will be removed from the 100 year floodplain

Final design of each tentative map and its associated infrastructure, ie storm drains, channels, culverts and flood storage facilities should be evaluated to determine that the projects and facilities will not alter the overall framework for the project. If it is found necessary to deviate from this Master Plan, a revised Master Plan should be developed for review and approval by the City of Reno.

The Flood Storage Ordinance is a new concept within the Truckee Meadows and prior to the final design of the Flood Mitigation features, the City and the project developer should agree upon the responsibilities for maintenance and operation of the facilities. It is our recommendation that the city give serious consideration to Alternative 2 in Section 3.2. This alternative will allow the project to proceed while providing time for the City and the other governments in the region to determine the best way to achieve their goals of maintaining the flood storage and safeguarding the flood control project.

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16

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Bella Vista Property

PHASE II CONSTRUCTION
PHASE I CONSTRUCTION

Wetlands

Wetlands

N
W E
S

SCALE

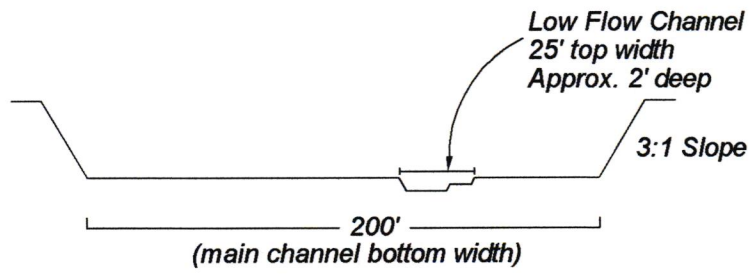
0 600' 1200 FEET

1 inch = 600 feet

LEGEND

- HEC-RAS Cross-Section Phase II
- HEC-RAS Cross-Section Phase I
- Bella Vista Project Boundary
- Phase II Designed Channel
- Wetlands
- 10 Ft Contour
- 2 Ft Contour

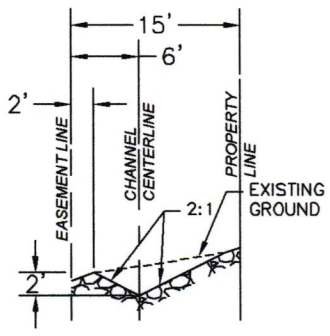
Typical Channel Cross-Section



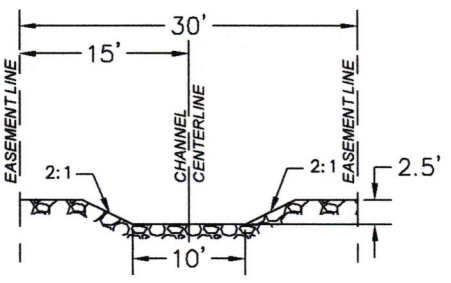
Vertical Exaggeration = 40:1

Horizontal Exaggeration = 8:1

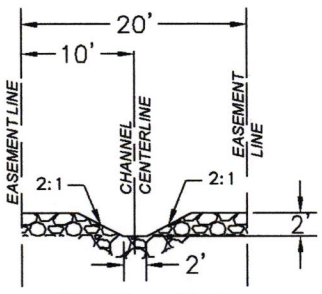
Sheet 1 of 1	FIGURE 9 Hydraulic Workmap Bella Vista Channel - Phase II *Centex Homes* *Washoe County* *Nevada*	Scale: 1" = 600' CI: detailed contours = 10 Feet File Name: 0432_Figs2,3,9.dwg Drawn By: GH Designed By: DW	*Revisions:*
Quad Knopf Job # N0432			Quad Knopf 9600 Prototype Ct. Reno, Nevada 89521 TEL: (775) 324-1212 FAX: (775) 324-2311 WEB: www.quadknopf.com N0432
Date: Jan. 2006			



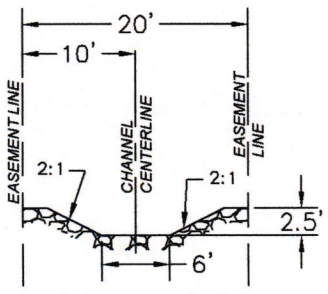
Typical Section of Eastern Boundary Channel



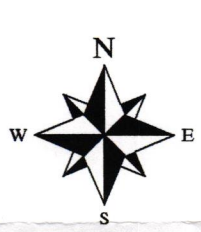
Section A-A



Section B-B



Section C-C



SCALE

400' 0 200' 400'

1 inch = 400 feet

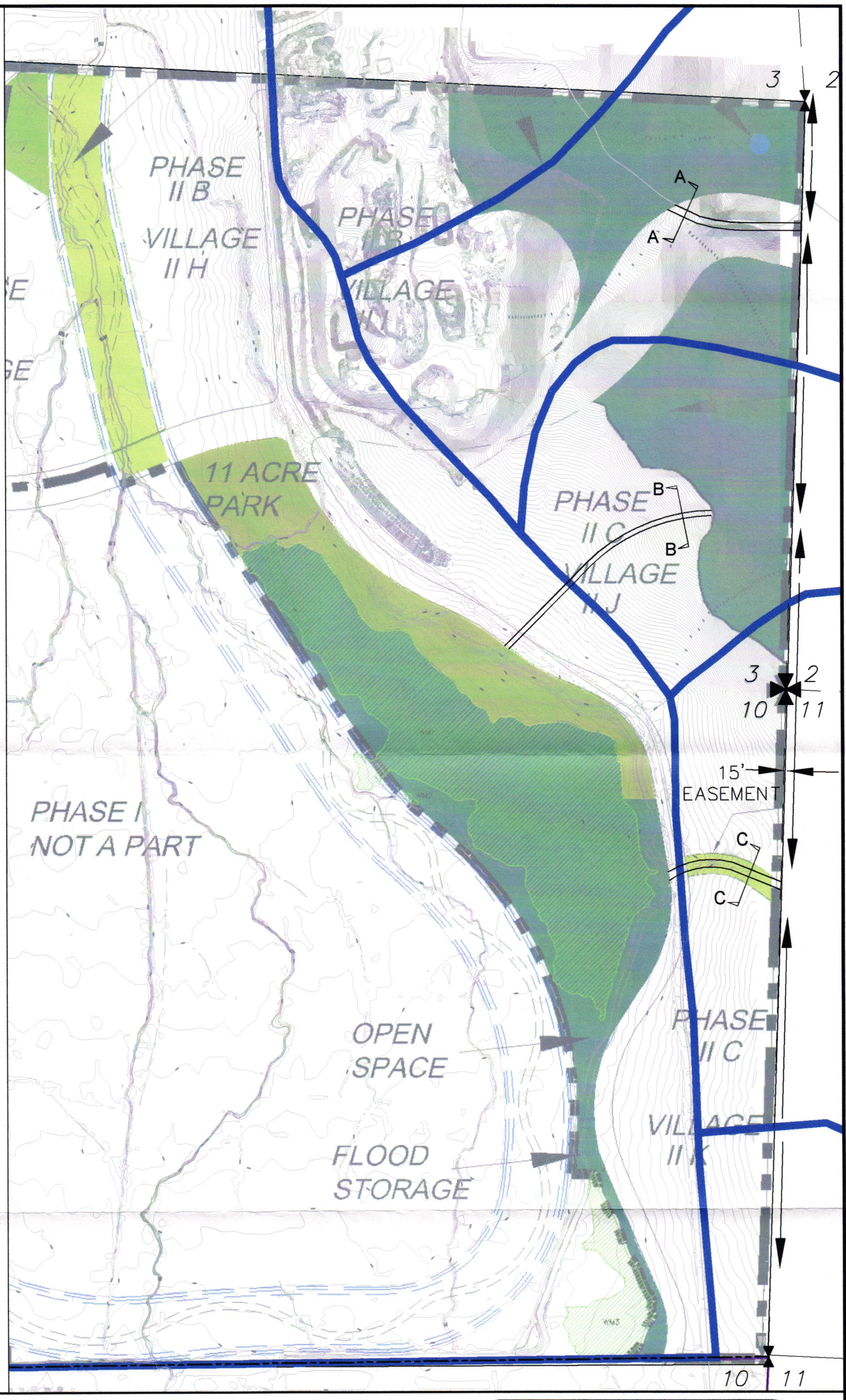


FIGURE 10

Channel Delineations

Bella Vista Ranch - Phase II

Centex Homes

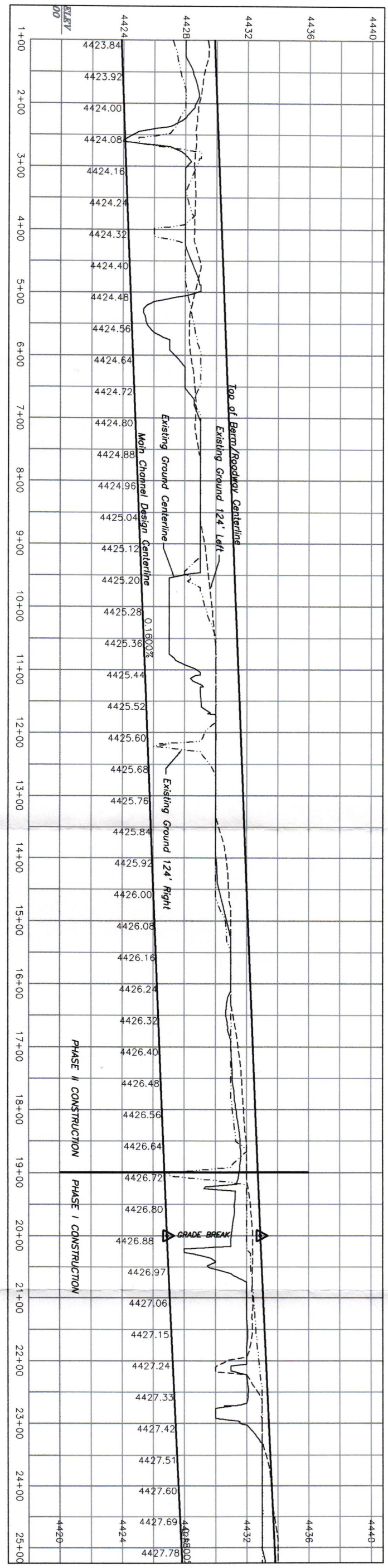
Quad Knopf Job #: N0432
File: 0432_Figs2,3,9.dwg

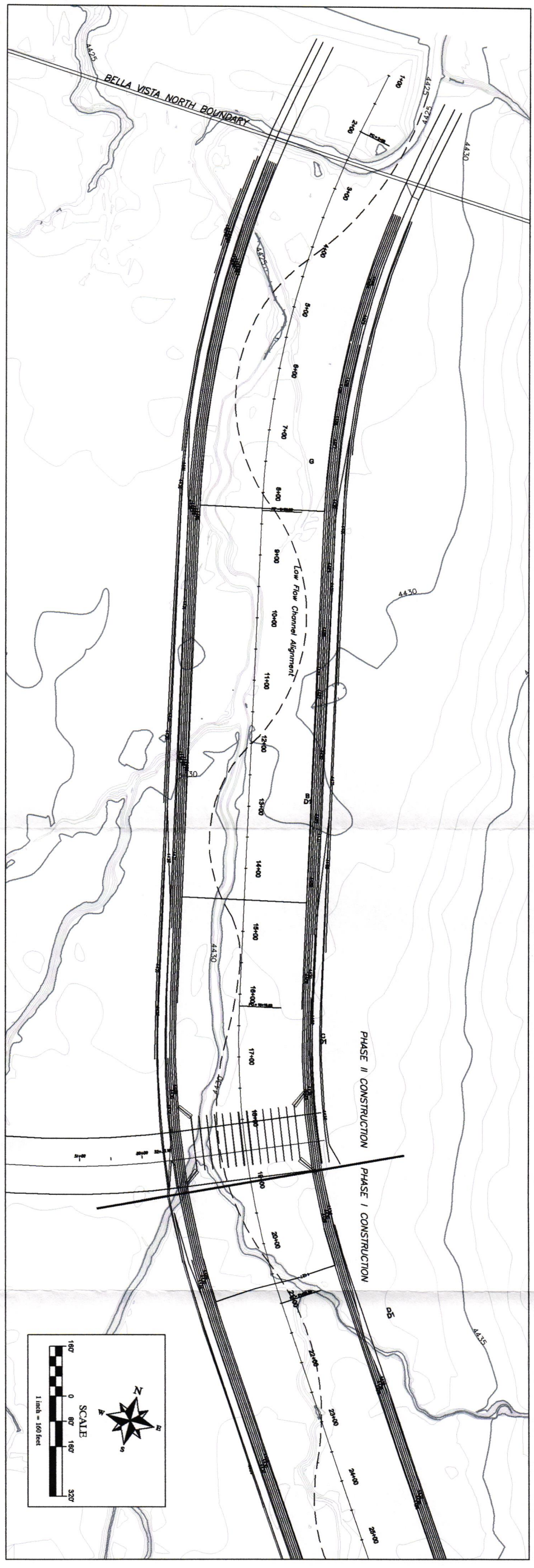
Date: January, 2006

9600 Prototype Ct.
Reno, Nevada 89521
TEL: (775) 324-1212
FAX: (775) 324-2311
WEB: www.quadknopf.com

Quad Knopf

N0432





Sheet C1	PRELIMINARY PLAN AND PROFILE STEAMBOAT CHANNEL BELLA VISTA RANCH - PHASE II *Centex Homes, Inc.* *Reno* *Washoe County* *Nevada*	Scale: 1" = 160'	Revisions:	Date:	References
Quad Knopf Job # N0432		Contour Interval: 1 foot			
Jan, 2006		File: 0432_CONST PLANS_PHASE2			
		Drawn By: GH			
		Designed By: RH			

Quad Knopf
9600 Prototype Ct.
Reno, Nevada 89521
TEL: (775) 324-1212
FAX: (775) 324-2311
WEB: www.quadknopf.com
N0432

APPENDIX A

EXISTING AND PROPOSED CONDITIONS HEC-1 MODELS
HEC-RAS MODELS

APPENDIX B
CHANNEL DESIGN

BELA VISTA RANCH: W.SHED D4 EXISTING

Sub-basin ID	Area (acres)	Area (sq miles)	Curve Number	Channel Type	Total Length (ft)	Total Length (miles)	Upper Elevation	Lower Elevation	Slope	Slope %	slope (ft/mile)	Kn	lag time
A	398.39	0.622	73	OL	**0.0**	0.0							
				natural chan	**9139.7**	1.7	5320	4448.5	0.095	**9.54%**	503.465	0.070	**0.712**
				street/gutter	**0.0**	0.0							
				L	**9139.7**	1.7							
				Lc	**6527.8**	1.2							
B	44.10	0.069	73	OL	**0.0**	0.0							
				natural chan	**2513.5**	0.5	4870	4449	0.167	**16.75%**	884.376	0.070	**0.237**
				street/gutter	**0.0**	0.0							
				L	**2513.5**	0.5							
				Lc	**1120.4**	0.2							
C	43.90	0.069	73	OL	**0.0**	0.0							
				natural chan	**2869.8**	0.5	6370	5295	0.375	**37.46%**	1977.838	0.070	**0.230**
				street/gutter	**0.0**	0.0							
				L	**2869.8**	0.5							
				Lc	**1332.1**	0.3							

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*            VERSION 4.1                *
*                                       *
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*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*         609 SECOND STREET             *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 756-1104              *
*                                       *
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X     X  X        X              X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX         XXX
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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


```
          LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

                        *DIAGRAM
            1           ID   ===========================================================================
            2           ID   | Bella Vista Ranch                                                     |
            3           ID   | HYDROLOGIC ANALYSIS                                                   |
            4           ID   | EXISTING CONDITIONS                                                     |
            5           ID   | Washoe County, Nevada                                                   |
            6           ID   |                                                                         |
            7           ID   |  100-Year Analysis                                                      |
            8           ID   |                                                                         |
            9           ID   | File: EX-0432.DAT                          Quad Knopf , Inc.            |
           10           ID   | September 2005                             9600 Prototype Ct.           |
           11           ID   | Project No.   0432                         Reno, Nevada  89521          |
           12           ID   |                                            (775)324-1212,FAX 324-2311|
           13           ID   ===========================================================================
           14           IT      5                    300
           15           IO      5       0
           16           IN     15
                        *
                        *  TOTAL WATERSHED AREA = 0.805 SQ. MI.
                        *  AREAL REDUCTION = 0.94
           17           JR    PREC    0.94

           18           KK    A   GENERATE HYDROGRAPH FOR MAIN WATERSHED A
           19           KM    CALCULATE RUNOFF FROM WATERSHED A
           20           BA    0.72
           21           PB    2.5
           22           PC     0.0    .002    .005    .008    .011    .014    .017    .020    .023    .026
           23           PC    .029    .032    .035    .038    .041    .044    .048    .052    .056    .060
           24           PC    .064    .068    .072    .076    .080    .085    .090    .095    .100    .105
           25           PC    .110    .115    .120    .126    .133    .140    .147    .155    .163    .172
           26           PC    .181    .191    .203    .218    .236    .257    .283    .387    .663    .707
           27           PC    .735    .758    .776    .791    .804    .815    .825    .834    .842    .849
           28           PC    .856    .863    .869    .875    .881    .887    .893    .898    .903    .908
           29           PC    .913    .918    .922    .926    .930    .934    .938    .942    .946    .950
           30           PC    .953    .956    .959    .962    .965    .968    .971    .974    .977    .980
           31           PC    .983    .986    .992    .995    .998   1.00
           32           LS      0      73
           33           UD    0.71
                        *

           34           KK    B   GENERATE HYDROGRAPH FOR SMALL WATERSHED B
           35           KM    CALCULATE RUNOFF FROM WATERSHED B
           36           BA    0.04
           37           PB    2.5
           38           LS      0      73
           39           UD    0.234
                        *

           40           KK    C   GENERATE HYDROGRAPH FOR WATERSHED C
           41           KM    CALCULATE RUNOFF FROM WATERSHED C
           42           BA    0.04
           43           PB    2.5
           44           LS      0      73
           45           UD    0.23
                        *
```



```
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1

SCHEMATIC DIAGRAM OF STREAM NETWORK

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  NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

   18       A
            .
            .
   34       .        B
```

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                .           .
                .           .
   40           .           .        C

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
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 *               JUN   1998              *
 *            VERSION 4.1                *
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*    U.S. ARMY CORPS OF ENGINEERS    *
*    HYDROLOGIC ENGINEERING CENTER   *
*          609 SECOND STREET         *
*        DAVIS, CALIFORNIA 95616     *
*           (916) 756-1104           *
*                                    *
**************************************
```

```
| Bella Vista Ranch                                                    |
| HYDROLOGIC ANALYSIS                                                  |
| EXISTING CONDITIONS                                                  |
| Washoe County, Nevada                                                |
|                                                                      |
|  100-Year Analysis                                                   |
|                                                                      |
| File: EX-0432.DAT                          Quad Knopf , Inc.         |
| September 2005                             9600 Prototype Ct.        |
| Project No.   0432                         Reno, Nevada  89521       |
|                                            (775)324-1212,FAX 324-2311|
```

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  15 IO          OUTPUT CONTROL VARIABLES
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                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN           5  MINUTES IN COMPUTATION INTERVAL
                       IDATE       1   0  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ         300  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE       2   0  ENDING DATE
                      NDTIME        0055  ENDING TIME
                      ICENT           19  CENTURY MARK

                    COMPUTATION INTERVAL      .08 HOURS
                        TOTAL TIME BASE    24.92 HOURS

           ENGLISH UNITS
                DRAINAGE AREA          SQUARE MILES
                PRECIPITATION DEPTH    INCHES
                LENGTH, ELEVATION      FEET
                FLOW                   CUBIC FEET PER SECOND
                STORAGE VOLUME         ACRE-FEET
                SURFACE AREA           ACRES
                TEMPERATURE            DEGREES FAHRENHEIT

     JP           MULTI-PLAN OPTION
                       NPLAN           1  NUMBER OF PLANS

     JR           MULTI-RATIO OPTION
                      RATIOS OF PRECIPITATION
                      .94
1
                PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
                              FLOWS IN CUBIC FEET PER SECOND,  AREA IN SQUARE MILES
                                                TIME TO PEAK IN HOURS

                                                                  RATIOS APPLIED TO PRECIPITATION
 OPERATION       STATION      AREA     PLAN                 RATIO 1
                                                                .94

 HYDROGRAPH AT
+                   A          .72      1    FLOW             87.
                                              TIME           12.75

 HYDROGRAPH AT
+                   B          .04      1    FLOW             10.
                                              TIME           12.17

 HYDROGRAPH AT
+                   C          .04      1    FLOW             10.
                                              TIME           12.17


 *** NORMAL END OF HEC-1 ***
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*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 756-1104              *
*                                       *
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X     X  X        X              X
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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


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LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

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    2         ID   | Bella Vista Ranch                                       |
    3         ID   | HYDROLOGIC ANALYSIS                                     |
    4         ID   | EXISTING CONDITIONS                                     |
    5         ID   | Washoe County, Nevada                                   |
    6         ID   |                                                         |
    7         ID   |  100-Year Analysis                                      |
    8         ID   |                                                         |
    9         ID   | File: EX-0432.DAT                  Quad Knopf , Inc.    |
   10         ID   | September 2005                     9600 Prototype Ct.   |
   11         ID   | Project No.   0432                 Reno, Nevada  89521  |
   12         ID   |                                    (775)324-1212,FAX 324-2311|
   13         ID   ==========================================================
   14         IT      5                  300
   15         IO      5       0
   16         IN     15
              *
              *  TOTAL WATERSHED AREA = 0.805 SQ. MI.
              *  AREAL REDUCTION = 0.94
   17         JR    PREC    0.94

   18         KK    A   GENERATE HYDROGRAPH FOR MAIN WATERSHED A
   19         KM    CALCULATE RUNOFF FROM WATERSHED A
   20         BA    0.72
   21         PB    2.5
   22         PC     0.0    .002    .005    .008    .011    .014    .017    .020    .023    .026
   23         PC    .029    .032    .035    .038    .041    .044    .048    .052    .056    .060
   24         PC    .064    .068    .072    .076    .080    .085    .090    .095    .100    .105
   25         PC    .110    .115    .120    .126    .133    .140    .147    .155    .163    .172
   26         PC    .181    .191    .203    .218    .236    .257    .283    .387    .663    .707
   27         PC    .735    .758    .776    .791    .804    .815    .825    .834    .842    .849
   28         PC    .856    .863    .869    .875    .881    .887    .893    .898    .903    .908
   29         PC    .913    .918    .922    .926    .930    .934    .938    .942    .946    .950
   30         PC    .953    .956    .959    .962    .965    .968    .971    .974    .977    .980
   31         PC    .983    .986    .992    .995    .998   1.00
   32         LS       0      73
   33         UD    0.71
              *

   34         KK    B   GENERATE HYDROGRAPH FOR SMALL WATERSHED B
   35         KM    CALCULATE RUNOFF FROM WATERSHED B
   36         BA    0.04
   37         PB    2.5
   38         LS       0      73
   39         UD    0.234
              *

   40         KK    C   GENERATE HYDROGRAPH FOR WATERSHED C
   41         KM    CALCULATE RUNOFF FROM WATERSHED C
   42         BA    0.04
   43         PB    2.5
   44         LS       0      73
   45         UD    0.23
              *
```



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LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

   46         KK   ABC   COMBINE FLOWS
   47         HC       3
              *

   48         KK      D3   BELLA VISTA RANCH WATERSHED 3
   49         KM    CALCULATE RUNOFF FROM WATERSHED 3
   50         BA     0.7
   51         PB     2.5
   52         LS              79
   53         UD    0.77
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            54          ZZ
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                SCHEMATIC DIAGRAM OF STREAM NETWORK

 INPUT
  LINE      (V) ROUTING           (--->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR         (<---) RETURN OF DIVERTED OR PUMPED FLOW

    18        A
                .
                .
    34          .       B
                .         .
                .         .
    40          .         .       C
                .         .         .
                .         .         .
    46        ABC  ......................
                .
                .
    48          .         D3

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*             JUN  1998                *
*          VERSION 4.1                 *
*                                      *
*  RUN DATE   13JAN06  TIME  14:51:56  *
*                                      *
****************************************

****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*        DAVIS, CALIFORNIA 95616       *
*           (916) 756-1104             *
*                                      *
****************************************
```

Bella Vista Ranch HYDROLOGIC ANALYSIS EXISTING CONDITIONS Washoe County, Nevada 100-Year Analysis File: EX-0432.DAT September 2005 Project No. 0432	Quad Knopf , Inc. 9600 Prototype Ct. Reno, Nevada 89521 (775)324-1212,FAX 324-2311

```
  15 IO          OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT           HYDROGRAPH TIME DATA
                       NMIN          5  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1    0  STARTING DATE
                      ITIME        0000  STARTING TIME
                         NQ         300  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      2    0  ENDING DATE
                     NDTIME        0055  ENDING TIME
                      ICENT          19  CENTURY MARK

                   COMPUTATION INTERVAL      .08 HOURS
                       TOTAL TIME BASE    24.92 HOURS

          ENGLISH UNITS
               DRAINAGE AREA          SQUARE MILES
               PRECIPITATION DEPTH    INCHES
               LENGTH, ELEVATION      FEET
               FLOW                   CUBIC FEET PER SECOND
               STORAGE VOLUME         ACRE-FEET
               SURFACE AREA           ACRES
               TEMPERATURE            DEGREES FAHRENHEIT

     JP          MULTI-PLAN OPTION
                      NPLAN          1  NUMBER OF PLANS

     JR          MULTI-RATIO OPTION
                 RATIOS OF PRECIPITATION
                 .94
1

               PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
                                FLOWS IN CUBIC FEET PER SECOND,  AREA IN SQUARE MILES
                                          TIME TO PEAK IN HOURS

                                                                  RATIOS APPLIED TO PRECIPITATION
 OPERATION       STATION      AREA     PLAN                 RATIO 1
                                                               .94

 HYDROGRAPH AT
+                  A           .72      1    FLOW             87.
                                             TIME           12.75

 HYDROGRAPH AT
+                  B           .04      1    FLOW             10.
                                             TIME           12.17

 HYDROGRAPH AT
+                  C           .04      1    FLOW             10.
                                             TIME           12.17

   3 COMBINED AT
+                 ABC          .80      1    FLOW             92.
                                             TIME           12.67
```

```
 HYDROGRAPH AT
+                    D3        .70     1   FLOW          138.
                                           TIME        12.75


 *** NORMAL END OF HEC-1 ***
```

TRAPEZOIDAL CHANNEL ANALYSIS
NORMAL DEPTH COMPUTATION

January 13, 2006

PROGRAM INPUT DATA

DESCRIPTION	VALUE
Flow Rate (cfs)	92.0
Channel Bottom Slope (ft/ft)	0.03
Manning's Roughness Coefficient (n-value)	0.04
Channel Left Side Slope (horizontal/vertical)	2.0
Channel Right Side Slope (horizontal/vertical)	2.0
Channel Bottom Width (ft)	6.0

COMPUTATION RESULTS

DESCRIPTION	VALUE
Normal Depth (ft)	1.51
Flow Velocity (fps)	6.73
Froude Number	1.114
Velocity Head (ft)	0.7
Energy Head (ft)	2.22
Cross-Sectional Area of Flow (sq ft)	13.67
Top Width of Flow (ft)	12.06

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Phone:(281)440-3787, Fax:(281)440-4742, Email:software@dodson-hydro.com
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TRAPEZOIDAL CHANNEL ANALYSIS
NORMAL DEPTH COMPUTATION

January 13, 2006

PROGRAM INPUT DATA

DESCRIPTION	VALUE
Flow Rate (cfs)	10.0
Channel Bottom Slope (ft/ft)	0.03
Manning's Roughness Coefficient (n-value)	0.04
Channel Left Side Slope (horizontal/vertical)	2.0
Channel Right Side Slope (horizontal/vertical)	2.0
Channel Bottom Width (ft)	2.0

COMPUTATION RESULTS

DESCRIPTION	VALUE
Normal Depth (ft)	0.73
Flow Velocity (fps)	3.95
Froude Number	0.971
Velocity Head (ft)	0.24
Energy Head (ft)	0.97
Cross-Sectional Area of Flow (sq ft)	2.53
Top Width of Flow (ft)	4.92

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TRAPEZOIDAL CHANNEL ANALYSIS
NORMAL DEPTH COMPUTATION

January 13, 2006

PROGRAM INPUT DATA

DESCRIPTION	VALUE
Flow Rate (cfs)	138.0
Channel Bottom Slope (ft/ft)	0.05
Manning's Roughness Coefficient (n-value)	0.04
Channel Left Side Slope (horizontal/vertical)	2.0
Channel Right Side Slope (horizontal/vertical)	2.0
Channel Bottom Width (ft)	10.0

COMPUTATION RESULTS

DESCRIPTION	VALUE
Normal Depth (ft)	1.29
Flow Velocity (fps)	8.48
Froude Number	1.442
Velocity Head (ft)	1.12
Energy Head (ft)	2.41
Cross-Sectional Area of Flow (sq ft)	16.28
Top Width of Flow (ft)	15.17

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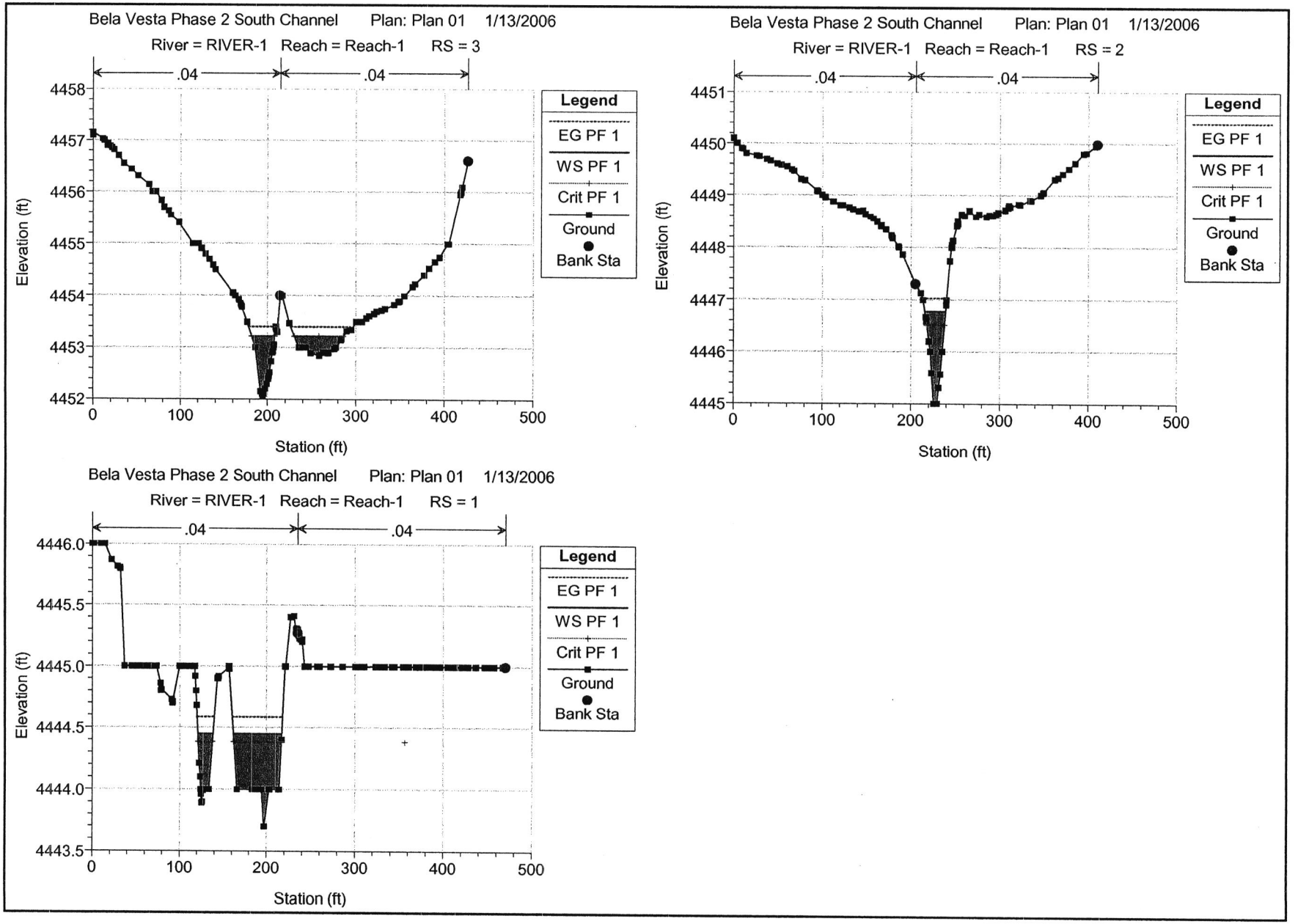
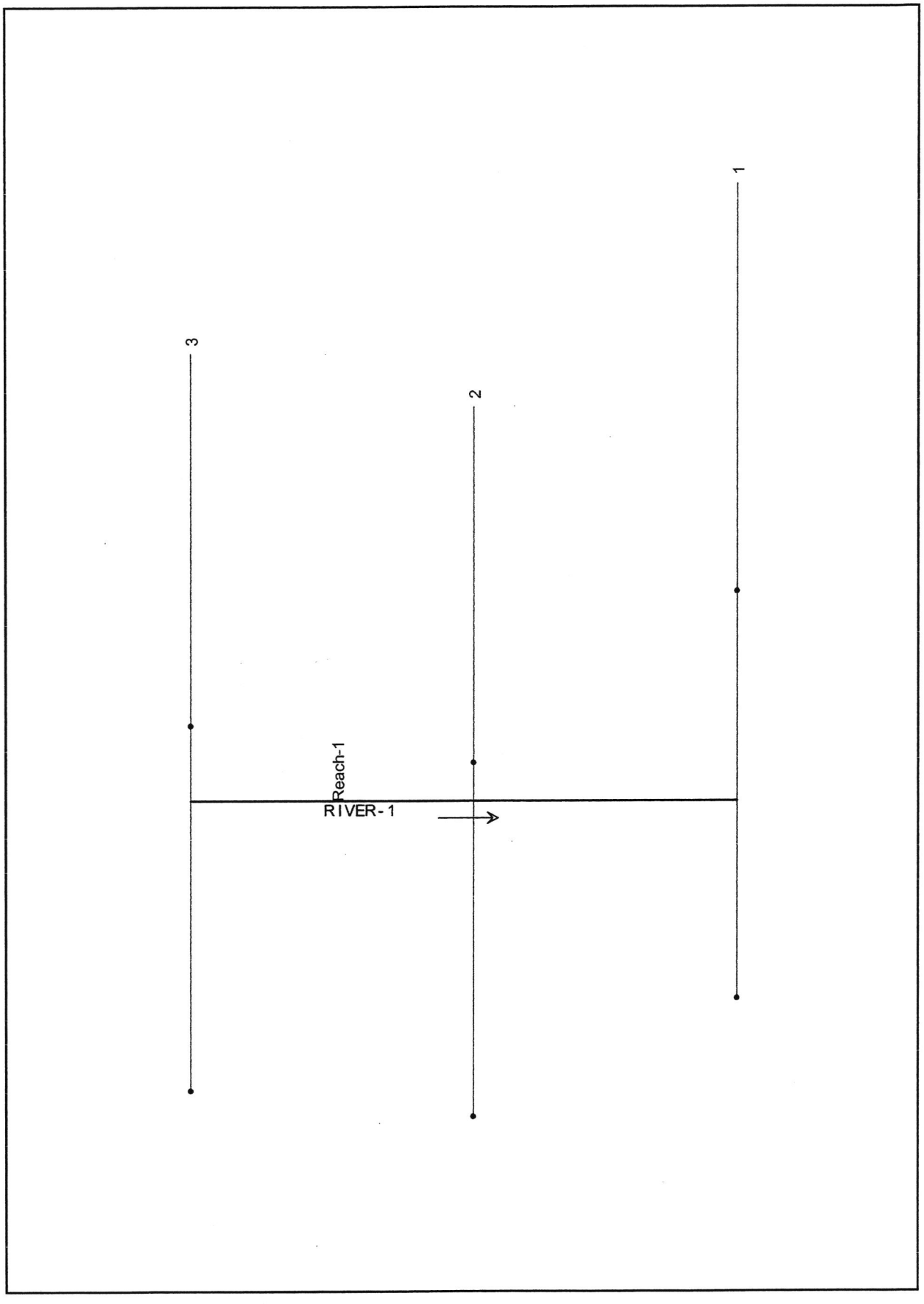
BELLA VESTA PHASE 2 - SOUTH CHANNEL (Existing Condition)

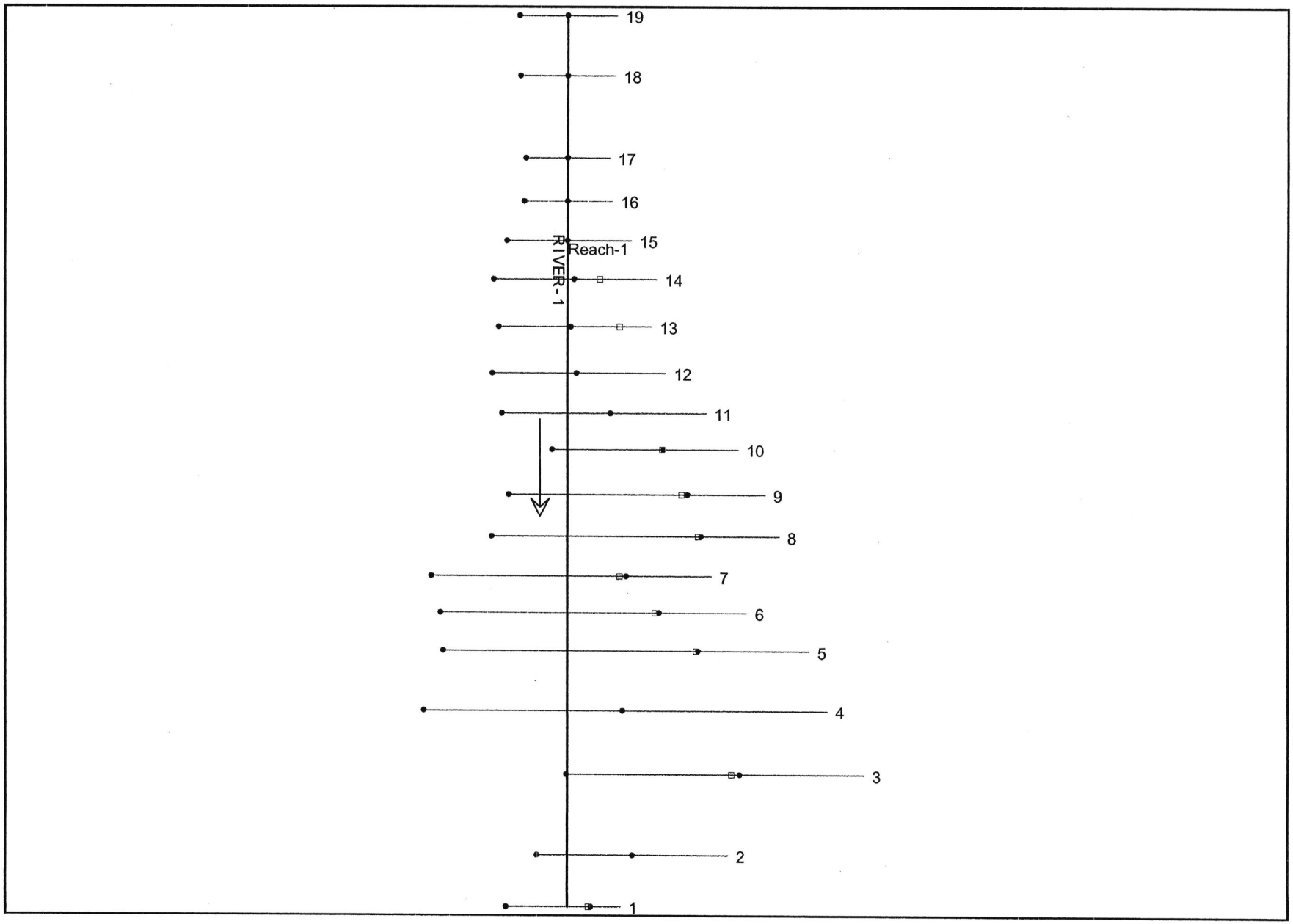
: RIVER-1 Reach: Reach-1 Profile: PF 1												
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	3	PF 1	92	4452.85	4453.22	4453.22	4453.4	0.019939	2.08	30.26	81.43	0.73
Reach-1	2	PF 1	92	4445	4446.78	4446.52	4447.03	0.012321	4.03	22.83	23.27	0.72
Reach-1	1	PF 1	92	4445	4444.45	4444.38	4444.59	0.020031		30.97	73.23	0

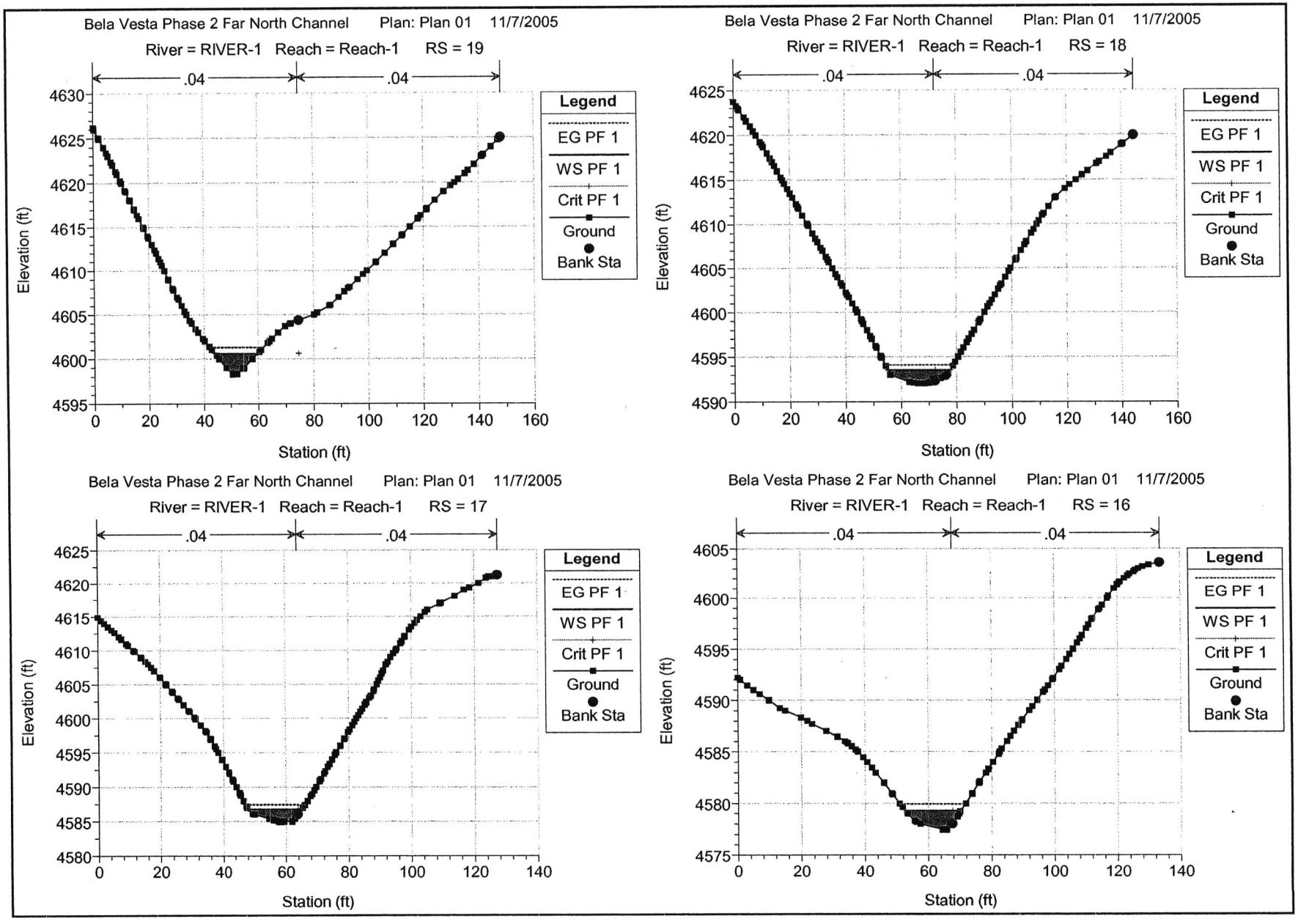

Bela Vesta Phase 2 South Channel Plan: Plan 01 1/13/2006
River = RIVER-1 Reach = Reach-1 RS = 3
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Bela Vesta Phase 2 South Channel Plan: Plan 01 1/13/2006
River = RIVER-1 Reach = Reach-1 RS = 2
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Bela Vesta Phase 2 South Channel Plan: Plan 01 1/13/2006
River = RIVER-1 Reach = Reach-1 RS = 1
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta

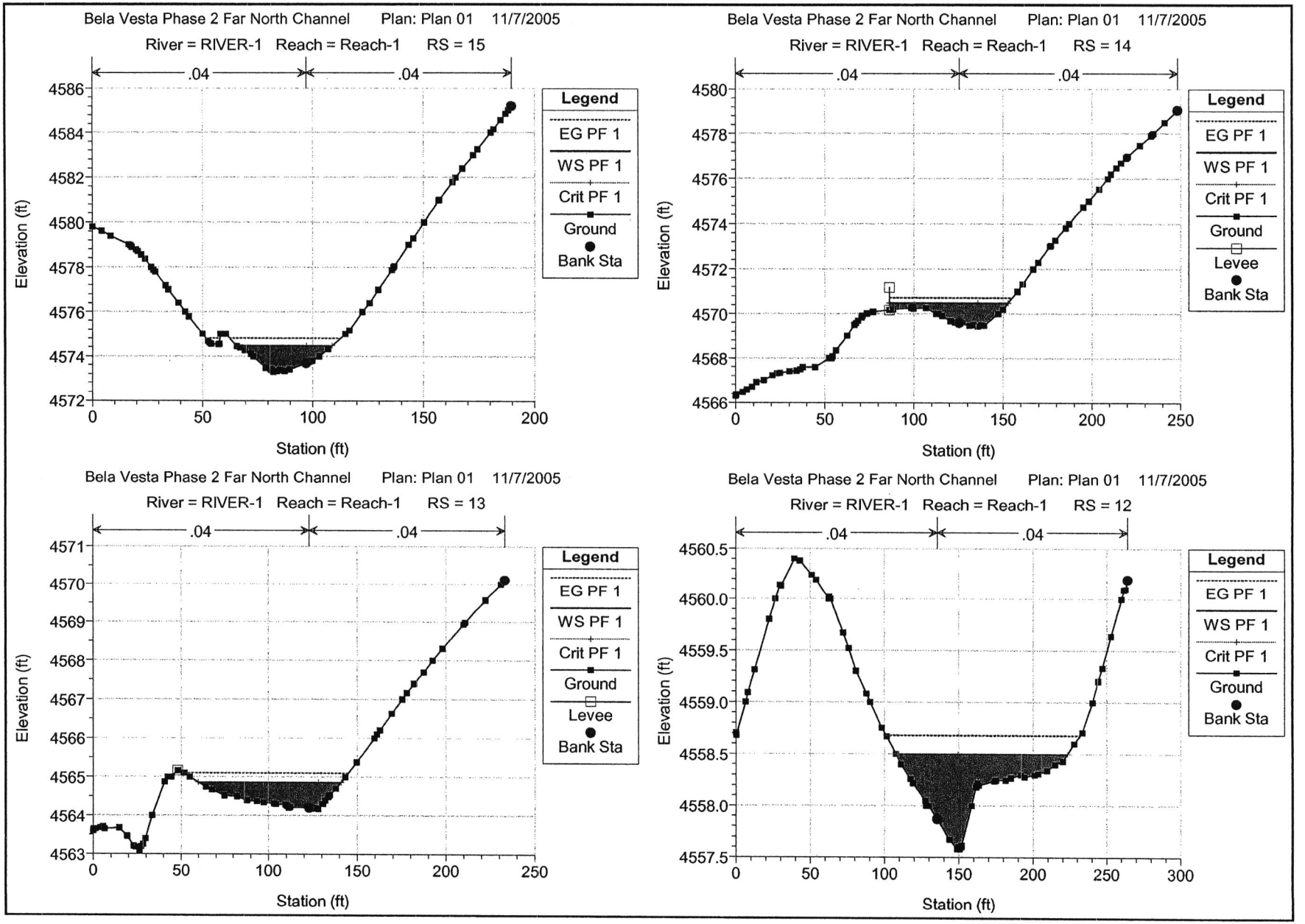

3
2
1
Reach-1
RIVER-1

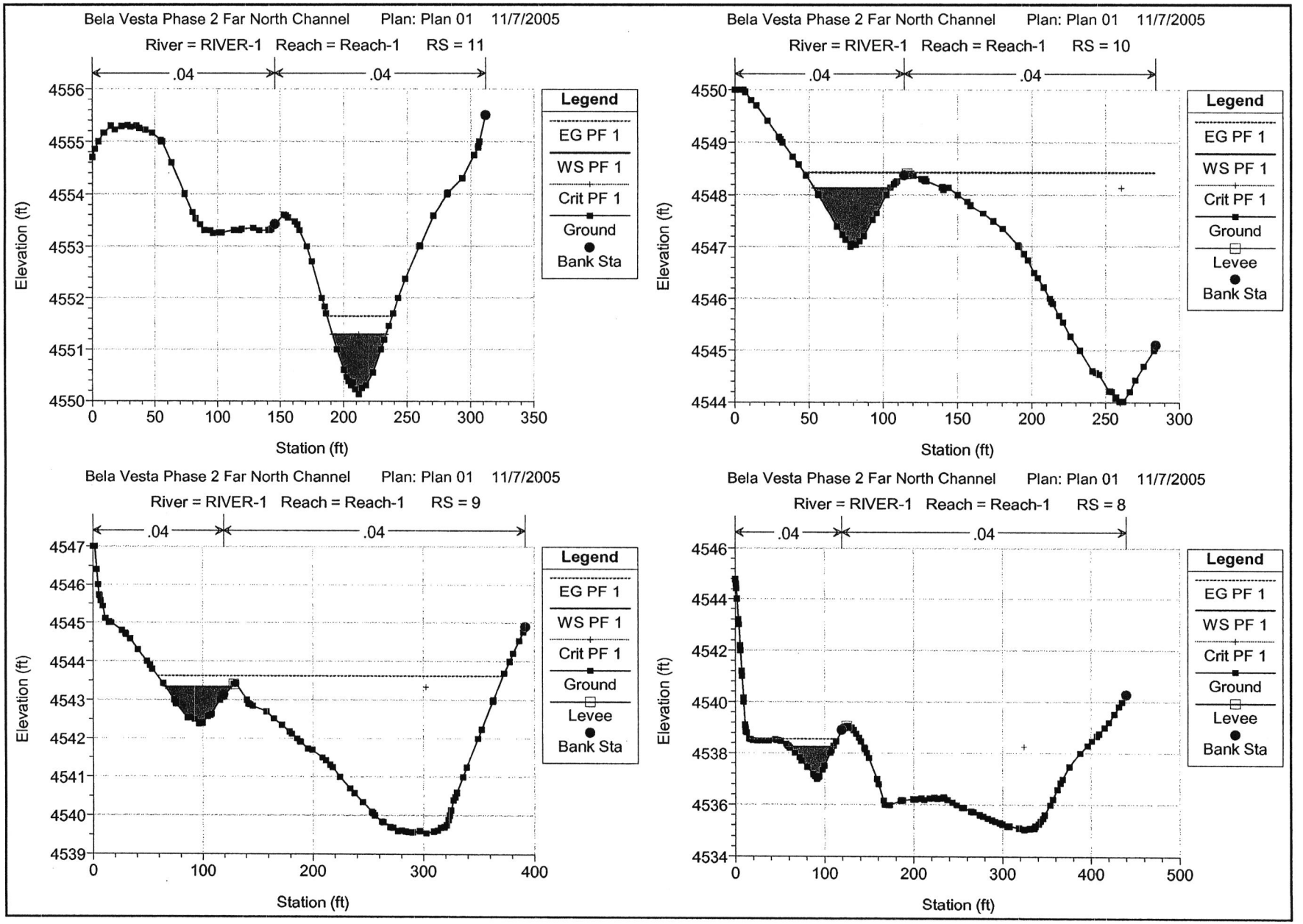
BELLA VESTA PHASE 2 - FAR NORTH CHANNEL (Existing Condition)

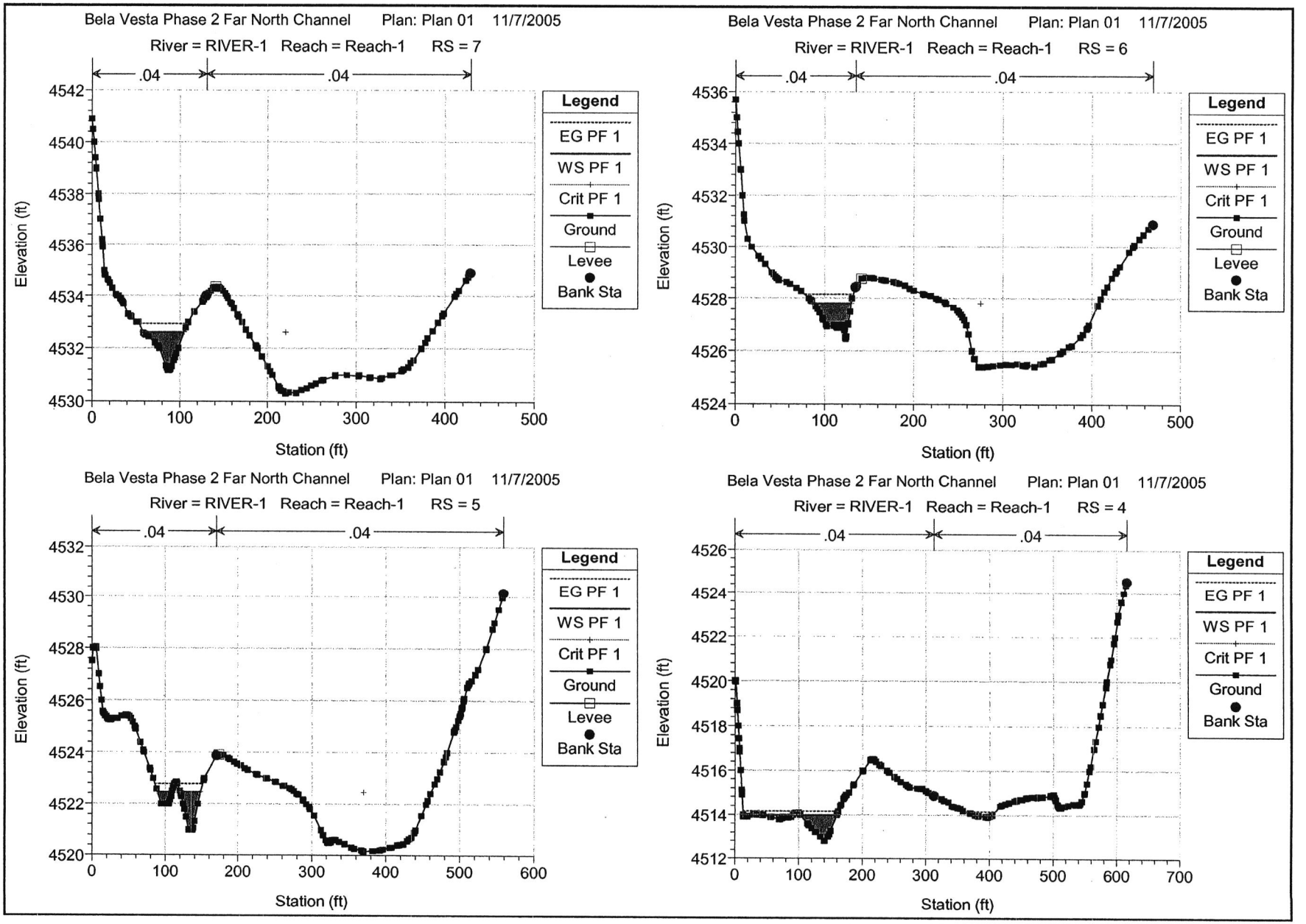
: RIVER-1 Reach: Reach-1 Profile: PF 1												
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	19	PF 1	138	4604.35	4600.61	4600.61	4601.28	0.023083		20.96	15.88	0
Reach-1	18	PF 1	138	4592.31	4593.51	4593.51	4594.05	0.022347	4.52	23.78	22.4	0.91
Reach-1	17	PF 1	138	4586	4586.8	4586.8	4587.46	0.021794	2.58	21.48	16.92	0.73
Reach-1	16	PF 1	138	4578	4579.31	4579.31	4579.94	0.021243	3.8	21.92	17.66	0.83
Reach-1	15	PF 1	138	4573.68	4574.47	4574.47	4574.82	0.024432	3.38	29.73	43.17	0.89
Reach-1	14	PF 1	138	4569.44	4570.48	4570.48	4570.72	0.019849	4.37	37.08	66.54	0.88
Reach-1	13	PF 1	138	4564.17	4564.87	4564.87	4565.1	0.031699	3.81	35.94	81.2	1.01
Reach-1	12	PF 1	138	4557.58	4558.5	4558.5	4558.68	0.033235	3.43	40.8	115.7	1.01
Reach-1	11	PF 1	138	4550.13	4551.3	4551.3	4551.65	0.026913	4.75	29.04	42.11	1.01
Reach-1	10	PF 1	138	4544.01	4548.13	4548.13	4548.42	0.026336		31.61	51.23	0
Reach-1	9	PF 1	138	4539.55	4543.34	4543.34	4543.62	0.025298	1.51	33.26	60.82	0.74
Reach-1	8	PF 1	138	4535.05	4538.25	4538.25	4538.55	0.026076		31.4	50.01	0
Reach-1	7	PF 1	138	4530.3	4532.62	4532.62	4532.93	0.026008		30.71	47.14	0
Reach-1	6	PF 1	138	4525.4	4527.81	4527.81	4528.15	0.02586		29.47	42.17	0
Reach-1	5	PF 1	138	4520.15	4522.46	4522.46	4522.77	0.023243		30.49	47.74	0
Reach-1	4	PF 1	138	4513.9	4514	4514	4514.16	0.016921	0.55	43.92	150.46	0.5
Reach-1	3	PF 1	138	4505.31	4506.74	4506.74	4507.01	0.020793		33.34	61.48	0
Reach-1	2	PF 1	138	4501	4497.37	4497.33	4497.58	0.025287		37.7	77.16	0
Reach-1	1	PF 1	138	4494.36	4495.05	4495.05	4495.5	0.02353		25.56	27.38	0

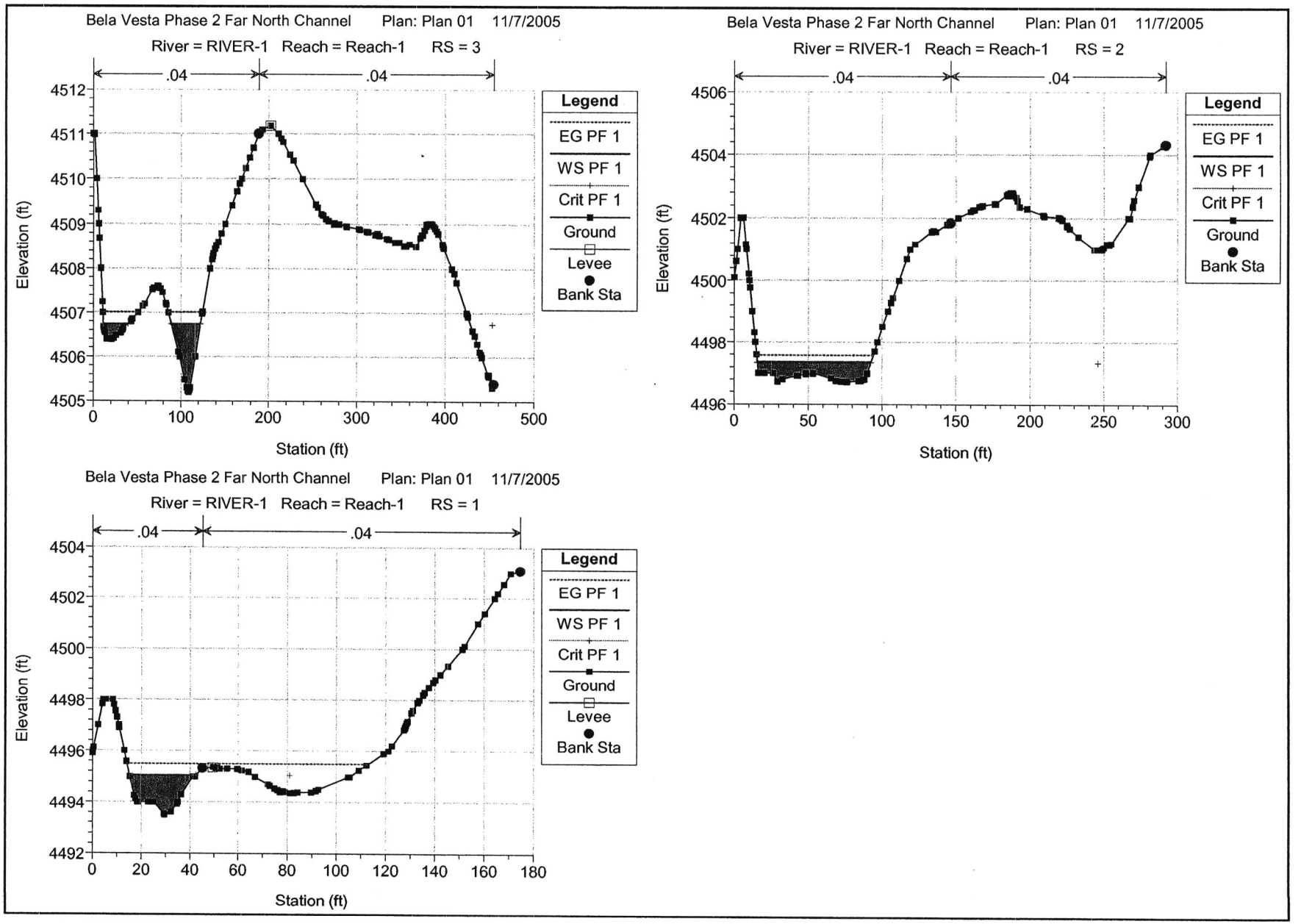

19
18
17
16
RIVER-1
Reach-1
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1


Bela Vesta Phase 2 Far North Channel Plan: Plan 01 11/7/2005
River = RIVER-1 Reach = Reach-1 RS = 19
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Bela Vesta Phase 2 Far North Channel Plan: Plan 01 11/7/2005
River = RIVER-1 Reach = Reach-1 RS = 18
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Bela Vesta Phase 2 Far North Channel Plan: Plan 01 11/7/2005
River = RIVER-1 Reach = Reach-1 RS = 17
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Bela Vesta Phase 2 Far North Channel Plan: Plan 01 11/7/2005
River = RIVER-1 Reach = Reach-1 RS = 16
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta


Bela Vesta Phase 2 Far North Channel Plan: Plan 01 11/7/2005
River = RIVER-1 Reach = Reach-1 RS = 15
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Bela Vesta Phase 2 Far North Channel Plan: Plan 01 11/7/2005
River = RIVER-1 Reach = Reach-1 RS = 14
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Bela Vesta Phase 2 Far North Channel Plan: Plan 01 11/7/2005
River = RIVER-1 Reach = Reach-1 RS = 13
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Bela Vesta Phase 2 Far North Channel Plan: Plan 01 11/7/2005
River = RIVER-1 Reach = Reach-1 RS = 12
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta

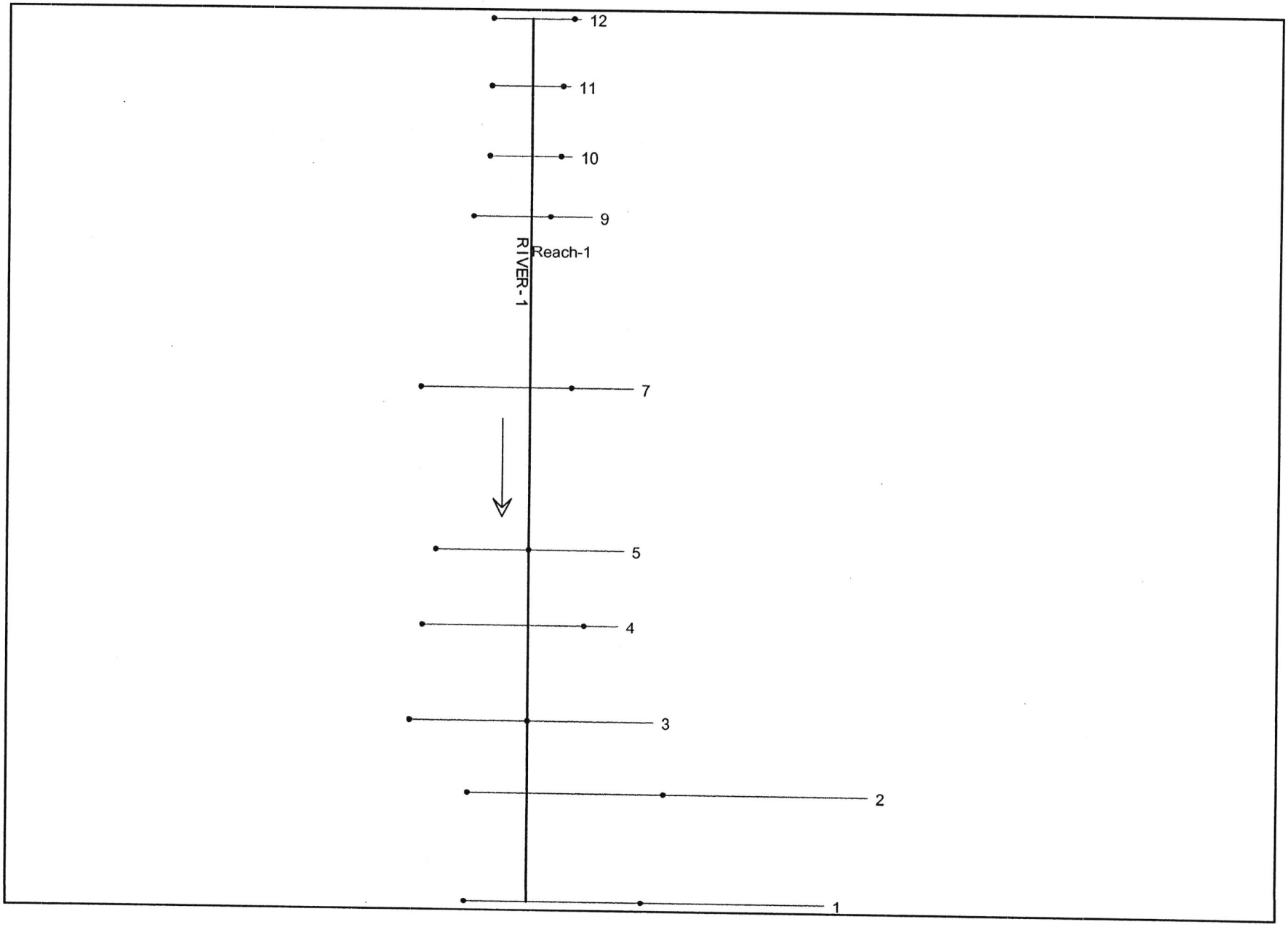

Bela Vesta Phase 2 Far North Channel Plan: Plan 01 11/7/2005
River = RIVER-1 Reach = Reach-1 RS = 11
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Bela Vesta Phase 2 Far North Channel Plan: Plan 01 11/7/2005
River = RIVER-1 Reach = Reach-1 RS = 10
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Bela Vesta Phase 2 Far North Channel Plan: Plan 01 11/7/2005
River = RIVER-1 Reach = Reach-1 RS = 9
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Bela Vesta Phase 2 Far North Channel Plan: Plan 01 11/7/2005
River = RIVER-1 Reach = Reach-1 RS = 8
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta

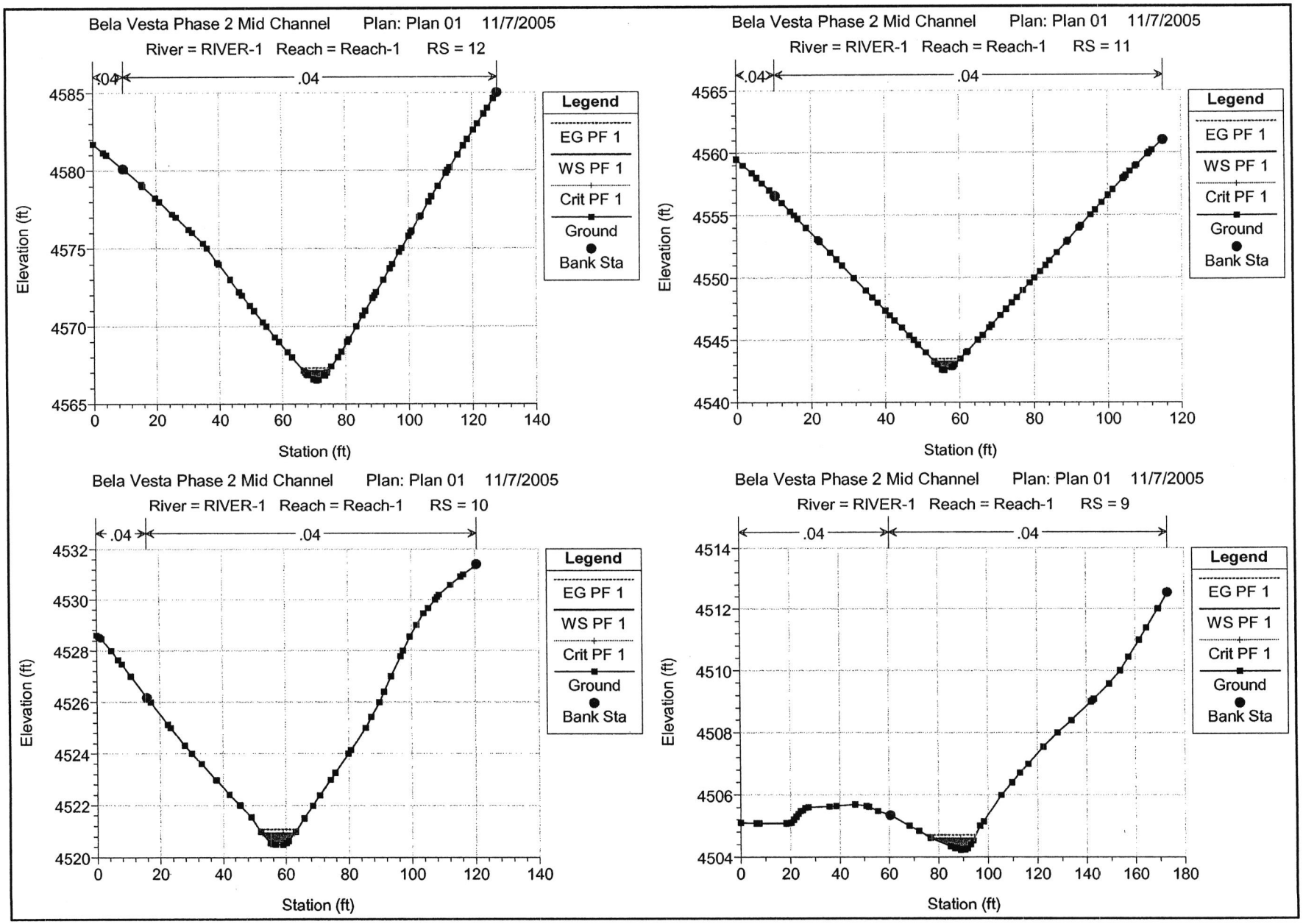

Bela Vesta Phase 2 Far North Channel Plan: Plan 01 11/7/2005
River = RIVER-1 Reach = Reach-1 RS = 7
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Bela Vesta Phase 2 Far North Channel Plan: Plan 01 11/7/2005
River = RIVER-1 Reach = Reach-1 RS = 6
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Bela Vesta Phase 2 Far North Channel Plan: Plan 01 11/7/2005
River = RIVER-1 Reach = Reach-1 RS = 5
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Bela Vesta Phase 2 Far North Channel Plan: Plan 01 11/7/2005
River = RIVER-1 Reach = Reach-1 RS = 4
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta

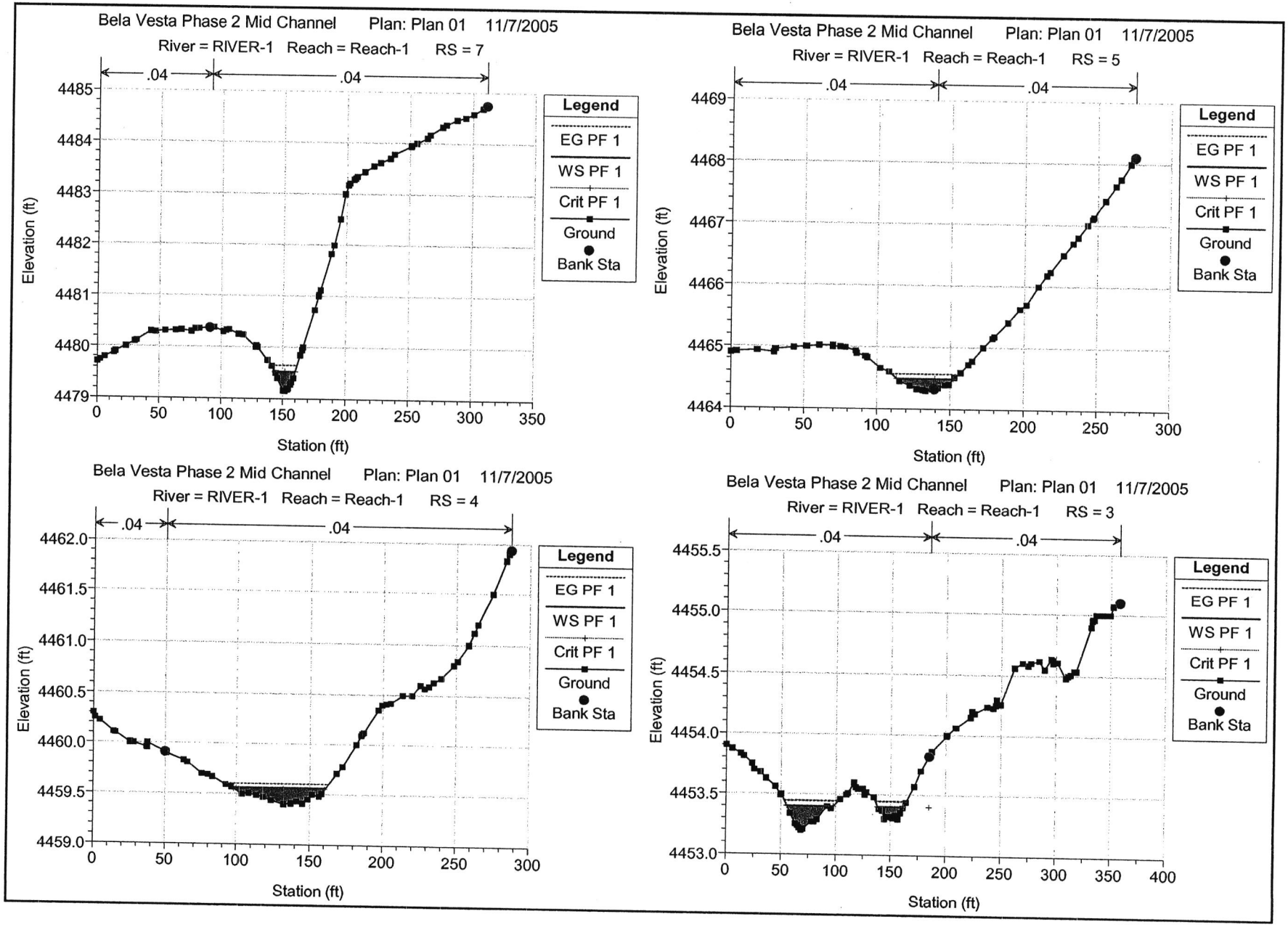

Bela Vesta Phase 2 Far North Channel Plan: Plan 01 11/7/2005
River = RIVER-1 Reach = Reach-1 RS = 3
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Bela Vesta Phase 2 Far North Channel Plan: Plan 01 11/7/2005
River = RIVER-1 Reach = Reach-1 RS = 2
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Bela Vesta Phase 2 Far North Channel Plan: Plan 01 11/7/2005
River = RIVER-1 Reach = Reach-1 RS = 1
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta

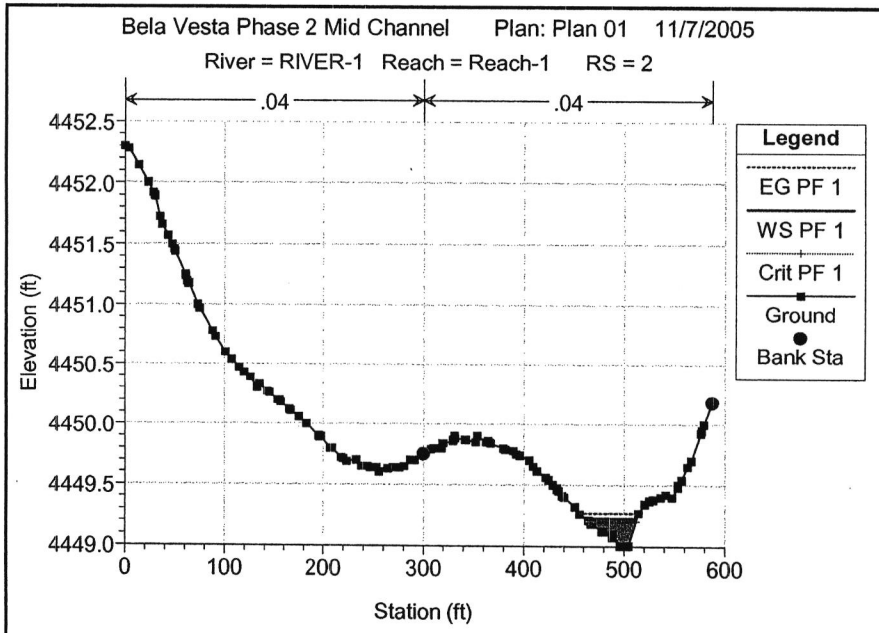
BELLA VESTA PHASE 2 - MID CHANNEL (Existing Condition)

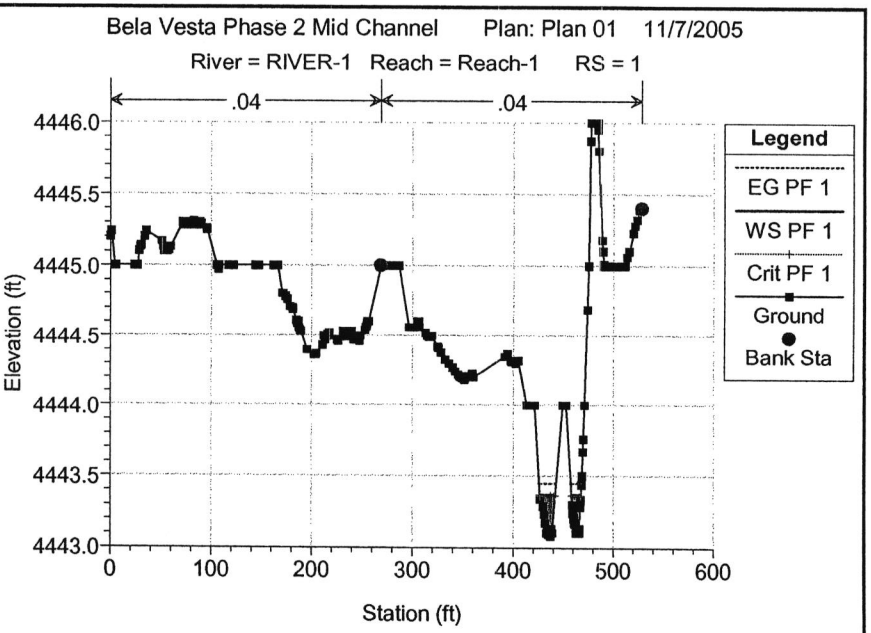
: RIVER-1 Reach: Reach-1 Profile: PF 1												
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	12	PF 1	10	4566.5	4567.12	4567.12	4567.3	0.033237	3.45	2.9	7.83	1
Reach-1	11	PF 1	10	4542.57	4543.27	4543.27	4543.48	0.032159	3.69	2.71	6.38	1
Reach-1	10	PF 1	10	4520.49	4520.94	4520.94	4521.09	0.034331	3.16	3.17	10.14	1
Reach-1	9	PF 1	10	4504.22	4504.6	4504.6	4504.71	0.038761	2.66	3.76	17.07	1
Reach-1	7	PF 1	10	4479.15	4479.53	4479.53	4479.64	0.039353	2.73	3.67	16.27	1.01
Reach-1	5	PF 1	10	4464.32	4464.49	4464.49	4464.56	0.048683	1.85	4.86	38.91	0.99
Reach-1	4	PF 1	10	4459.4	4459.57	4459.55	4459.6	0.039735	1.58	6.33	64.27	0.89
Reach-1	3	PF 1	10	4453.82	4453.4	4453.4	4453.45	0.049953		5.91	66.3	0
Reach-1	2	PF 1	10	4449	4449.23	4449.2	4449.27	0.027024	1.54	6.51	51.55	0.76
Reach-1	1	PF 1	10	4443.08	4443.37	4443.36	4443.45	0.035696	2.25	4.45	24.47	0.93

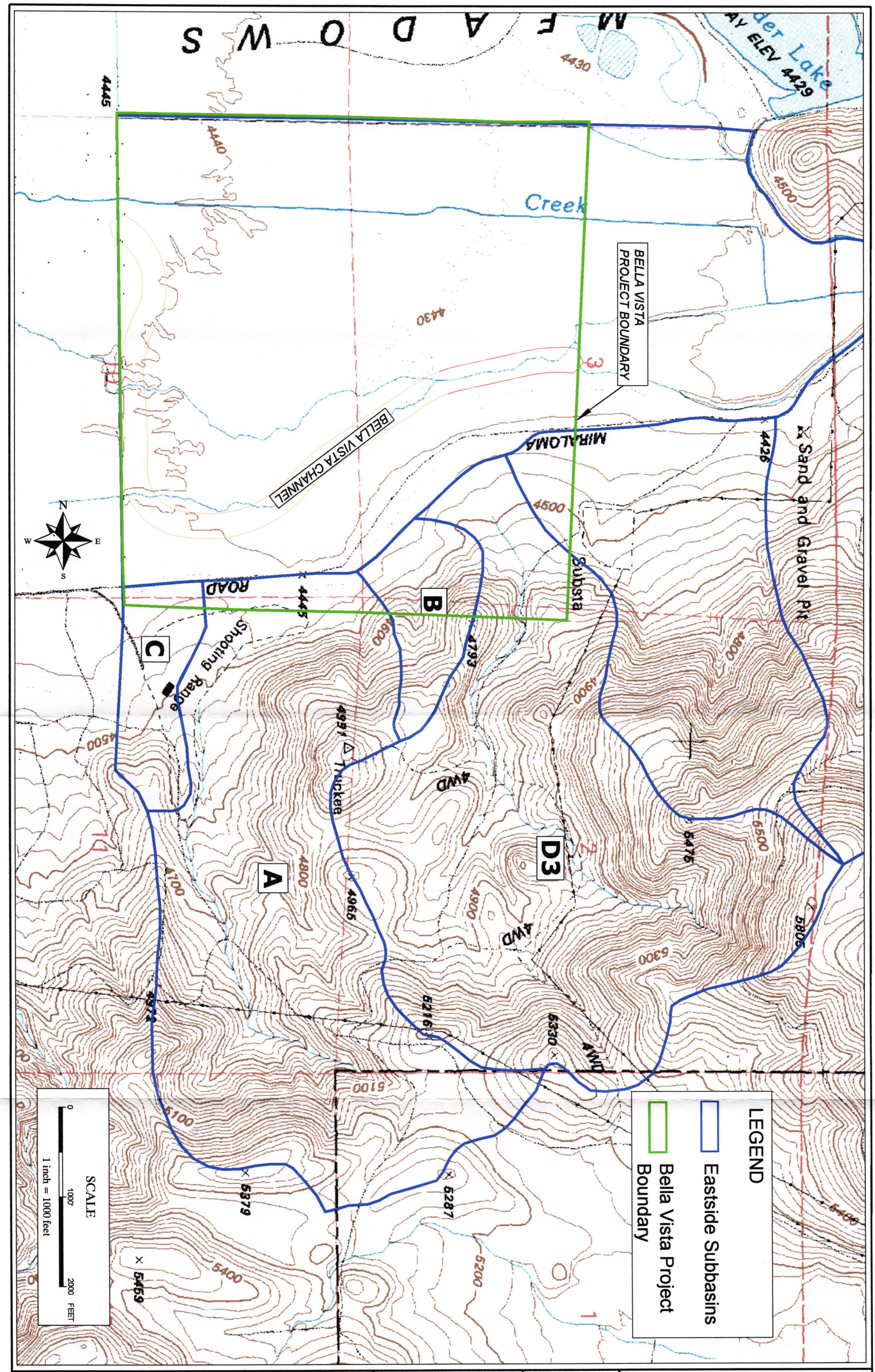

12
11
10
9
RIVER-1
Reach-1
7
5
4
3
2
1


Bela Vesta Phase 2 Mid Channel Plan: Plan 01 11/7/2005
River = RIVER-1 Reach = Reach-1 RS = 12
.04
.04
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Bela Vesta Phase 2 Mid Channel Plan: Plan 01 11/7/2005
River = RIVER-1 Reach = Reach-1 RS = 11
.04
.04
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Bela Vesta Phase 2 Mid Channel Plan: Plan 01 11/7/2005
River = RIVER-1 Reach = Reach-1 RS = 10
.04
.04
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Bela Vesta Phase 2 Mid Channel Plan: Plan 01 11/7/2005
River = RIVER-1 Reach = Reach-1 RS = 9
.04
.04
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)


Bela Vesta Phase 2 Mid Channel Plan: Plan 01 11/7/2005
River = RIVER-1 Reach = Reach-1 RS = 7
.04
.04
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Bela Vesta Phase 2 Mid Channel Plan: Plan 01 11/7/2005
River = RIVER-1 Reach = Reach-1 RS = 5
Bela Vesta Phase 2 Mid Channel Plan: Plan 01 11/7/2005
River = RIVER-1 Reach = Reach-1 RS = 4
Bela Vesta Phase 2 Mid Channel Plan: Plan 01 11/7/2005
River = RIVER-1 Reach = Reach-1 RS = 3


Bela Vesta Phase 2 Mid Channel Plan: Plan 01 11/7/2005
River = RIVER-1 Reach = Reach-1 RS = 2
.04
.04
Elevation (ft)
4452.5
4452.0
4451.5
4451.0
4450.5
4450.0
4449.5
4449.0
0
100
200
300
400
500
600
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta


Bela Vesta Phase 2 Mid Channel Plan: Plan 01 11/7/2005
River = RIVER-1 Reach = Reach-1 RS = 1
.04
.04
Elevation (ft)
4446.0
4445.5
4445.0
4444.5
4444.0
4443.5
4443.0
0
100
200
300
400
500
600
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta



Sheet 1 of 1	Eastside Subbasins - Hydrologic Workmap Bella Vista Channel - Phase II *Centex Homes* *Washoe County* *Nevada*	Scale: 1" = 1000' CI: detailed contours = 10 Feet File Name: 0432_Figs2,3,9.dwg Drawn By: GH Designed By: YT/RH	*Revisions:*
Quad Knopf Job # N0432			
Date: Jan. 2006			

Quad Knopf
9600 Prototype Ct.
Reno, Nevada 89521
TEL: (775) 324-1212
FAX: (775) 324-2311
WEB: www.quadknopf.com
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Sheet 1 of 1	Eastside Channels - HEC-RAS Cross Sections Bella Vista Channel - Phase II	Scale: 1" = 300'	Revisions:	9600 Prototype Ct. Reno, Nevada 89521 TEL: (775) 324-1212 FAX: (775) 324-2311 WEB: www.quadknopf.com
Quad Knopf Job # N0432	*Centex Homes*	CI: detailed contours = 10 Feet		Quad Knopf N0432
Date: Jan. 2006	*Washoe County* *Nevada*	File Name: 0432_PHASE-2-RAS.dwg		
		Drawn By: GH		
		Designed By: YT/RH		