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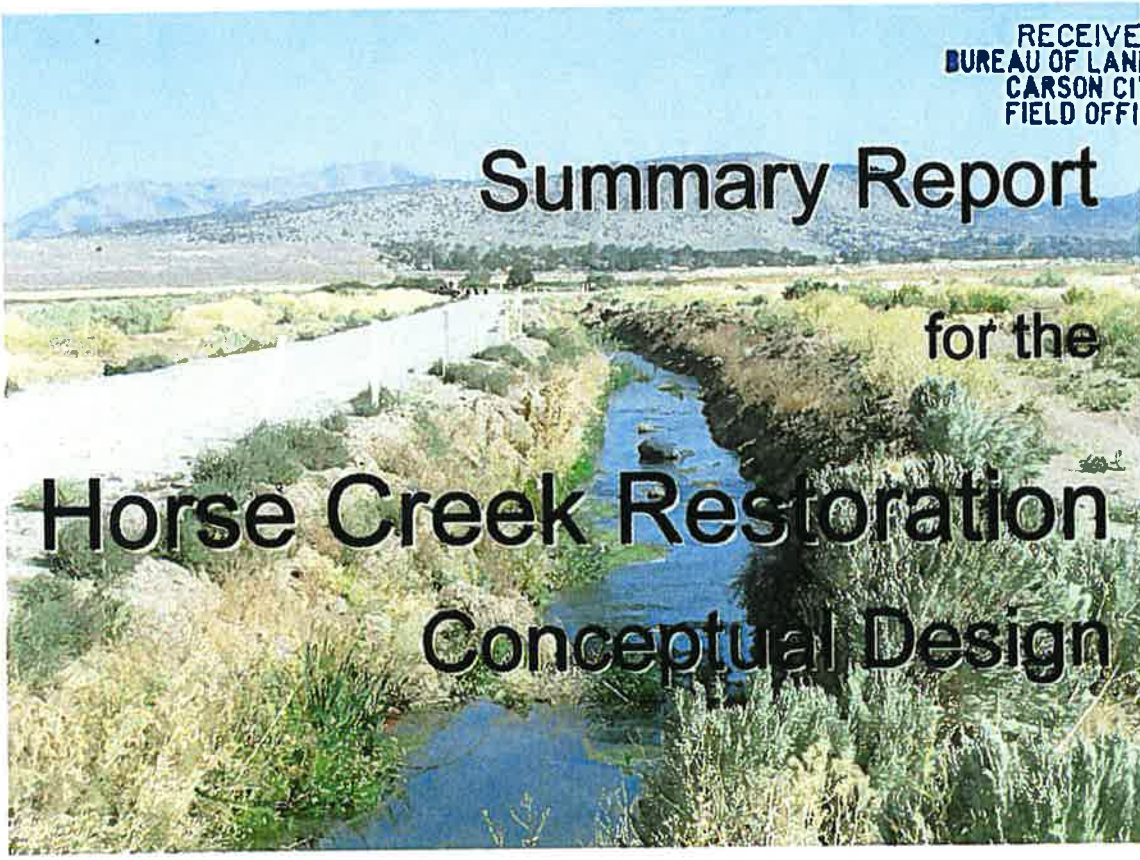

Summary Report for the Horse Creek Restoration Conceptual Design

PROFESSIONAL ENGINEER-STATE OF NEVADA
DENTON E. PETERS
CIVIL
3-10-08
No. 12087
EXP. 12/31/09

Prepared for:

Bureau of Land Management
Carson City Field Office
Carson City, NV

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1.0 Purpose.

The purpose of this Summary Report is to provide a brief explanation of the Conceptual Design prepared by ENTRIX, Inc. as commissioned by the Bureau of Land Management for a section of the Horse Creek tributary to Swan Lake in Reno, Nevada.

2.0 Scope of Work.

The Scope of Work for the Conceptual Design was to develop two alternatives for possible restoration improvements for a segment of Horse Creek situated slightly upstream of Swan Lake. This creek is also known by different names, including the Sage Point Channel and Swan Creek – the name "Horse Creek" is used herein for this segment.

3.0 Project Location and Description.

The Horse Creek segment under consideration resides within a 19-acre privately owned parcel (APN 580-041-01) situated east of Military Road (at Lear Boulevard) in the northwestern incorporated area of the city of Reno. The segment begins at the present terminal end of Lear Blvd. and proceeds downstream (to the north) for approximately 1,300 feet through the subject parcel (see Figure 1). The segment ends roughly 1,200 feet upstream of Swan Lake coinciding with the north property boundary of said parcel. The segment is unimproved with highly erosive and unstable banks. The channel section is incised with earthen banks and measures roughly 10 to 15-feet wide (bottom to top) and 4 to 5-feet deep (see Photo 1). This segment slopes at approximately 0.4% with a full-flow capacity of roughly 200 cubic-feet/second (cfs). The creek parallels the east boundary of the subject parcel and is primarily linear with little curvature and no sinuosity. It seems evident that this creek segment is not in a native or natural state and was apparently formed by excavation and earthwork activities within the subject parcel and the adjacent parcel to the east.

Photo 1. Horse Creek segment looking downstream from the end of Lear Blvd.

From: Stan Shumaker
To: Anne Debolt
CC: Lori Miles; Terri Svetich
Date: 2/25/2009 6:20 PM
Subject: warehouse property in Stead adjacent to flood channel

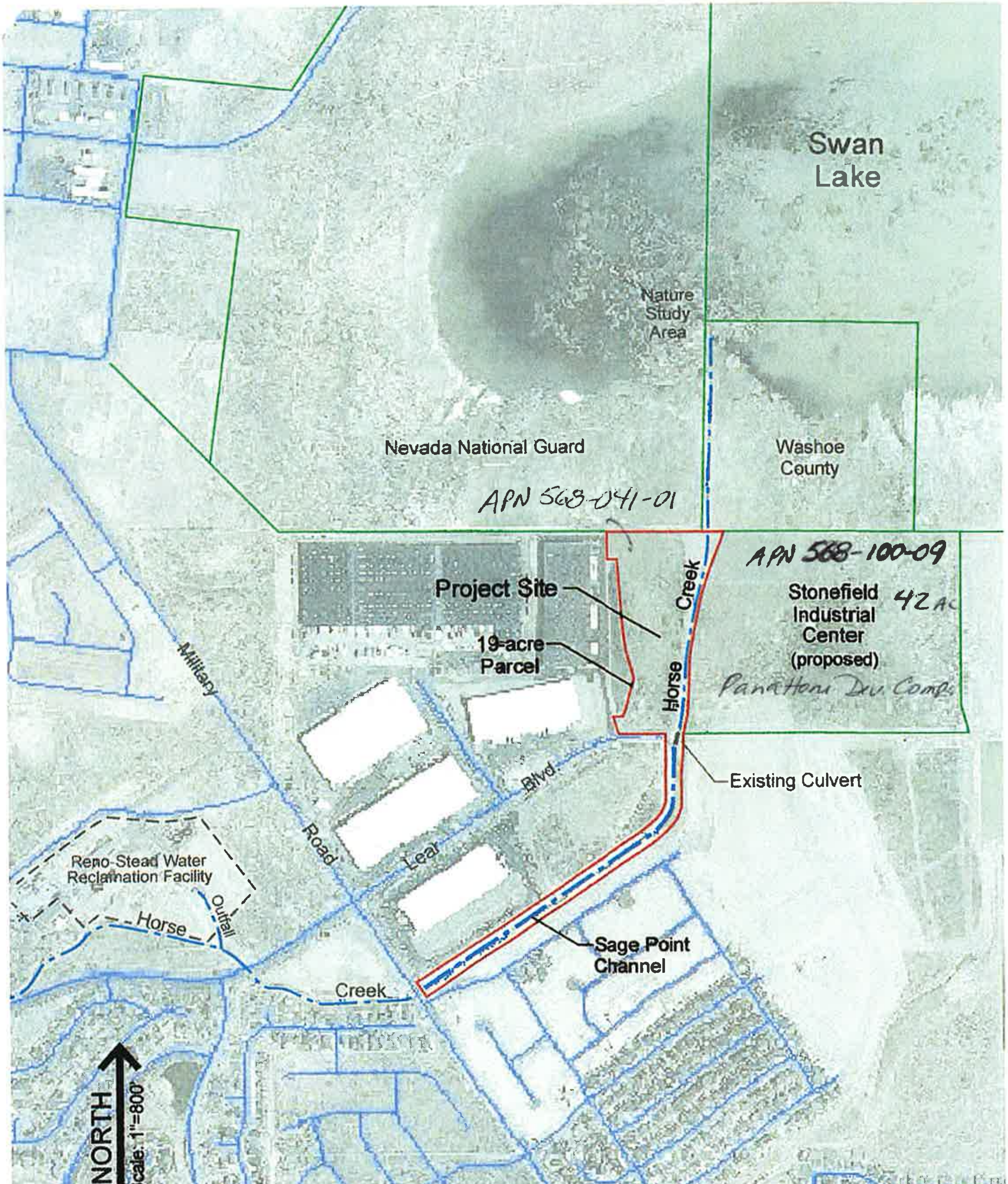
Anne,
At a meeting a few weeks ago you stated that the property (APN 568-100-09) purchased for warehouse development at the east end of Lear Blvd in Stead more than likely is entitled to an access to Lear Blvd. You offered to check the transfer of ownership records (from Lennar to Panattoni Development Company - Stonefield Industrial Center) to determine if this is true.

The only available access to the warehouse property from the east end of the paved section of Lear Blvd is a dirt road (built by parties unknown) which crosses a flood channel. This dirt road, built over a small culvert pipe placed in the channel, very effectively prevents the flood channel from conveying its design flood flow.

The question of access from Lear is related to whether or not the City of Reno should or may take ownership of the flood channel and the adjoining vacant land west of the warehouse property, currently owned by Lennar (APN 568-041-01), with this make-shift channel crossing in place. You indicated that the dirt road crossing the channel may need to be perpetuated for the benefit of the warehouse property.

You also indicated that if the channel and the road crossing are privately owned, then the access that the road provides to the warehouse property remains private and the problems that the road causes in terms of upkeep and flood issues remains a private concern.

Stan Shumaker
Sr. Civil Engineer
334-3309



Vicinity Map

FIGURE 1

Background image from the city of Reno GIS website, 2007 Orthophoto.

4.0 Design Objectives.

The main goals for the Horse Creek restoration alternatives, as defined by the BLM and other project stakeholders, include:

A. The reduction and/or minimization of sediment depositions into Swan Lake via Horse Creek perennial municipal and intermittent stormwater flows;

B. The restoration and improvement of the riparian habitat of the Horse Creek segment under consideration;

C. The improvement and future protection of water quality in Swan Lake;

D. The abandonment of the existing Horse Creek channel segment as it resides within and traverses through the subject parcel;

E. The avoidance of an extension of the Sage Point Channel, as recently constructed, from Lear Blvd. to Swan Lake; and

F. The establishment of an ecologically sensitive low flow and flood conveyance facility for the Horse Creek segment as the downstream extension of the Sage Point Channel.

5.0 Project Constraints.

Limits to the segment length under consideration were set by four important project and site constraints: Sage Point Channel, the proposed Stonefield Industrial Center, Lear Blvd., and the Nevada National Guard land to the north. The Sage Point Channel (an upstream portion of Horse Creek) is the channel segment immediately upstream from Lear Blvd. This channel was recently improved in conjunction with residential developments to the south/southeast of Lear Blvd. The improved section for Sage Point Channel is approximately 65-feet wide at the bottom, 95-feet wide at the top, and roughly 6 to 9-feet deep (see Photo 2). The channel bottom and banks are lined with erosion resistant blanketing to promote soil stability and vegetation. The improved portion of Sage Point Channel begins at Military Road and terminates at Lear Blvd. where it connects to the Horse Creek segment via a culvert. This portion of Sage Point Channel resides entirely within the 19-acre subject parcel. It is clear that the Sage Point Channel is a significant flood control facility and modifications to it in conjunction with the Horse Creek restoration alternatives were deemed unreasonable and cost prohibitive. Therefore, the Sage Point Channel represents a major upstream constraint and defines an upstream segment limitation.

As Figure 1 depicts, an industrial development is proposed for the parcel immediately east of the Horse Creek segment under consideration. The figure also shows the parcel immediately west of the subject parcel is developed. Preliminary plans for the Stonefield Industrial Center indicate the project, if constructed as initially proposed, would not alter or encroach into Horse Creek. However, the development will include earthwork (fill) and site improvements (parking facilities and buildings) that will prohibit the use of the land for possible Horse Creek restoration improvements. Therefore, except for possible site access opportunities, the Stonefield Industrial Center project is a site constraint that confines restoration alternatives to the subject parcel. As the aerial photography of Figure 1 illustrates, the parcel to the west of the subject parcel is developed but does include an existing detention basin that might be incorporated into restoration activities for the creek. This opportunity is further discussed in section 7.0.

Photo 2. Sage Point Channel looking upstream from the end of Lear Blvd.

With the development of the Stonefield Industrial Center, Lear Blvd. will need to be extended easterly from its current termination. Proposed with this extension is a required crossing of the Sage Point Channel/Horse Creek facility. Preliminary plans for the crossing include a proposed concrete box culvert system consisting of five 4-ft high by 10-ft wide boxes set side-by-side underneath the Lear Blvd. roadway. It is assumed this facility is preliminary designed and will be constructed to adequately convey the 100-year stormwater flow of 1,600 (cfs) anticipated for the fully improved Sage Point Channel.[1] For the purposes of the restoration alternatives, this facility was considered eminent and represents a major project constraint. As Lear Blvd. is currently a city of Reno roadway situated within public right-of-way, it is assumed that the roadway extension and box culvert improvements, once installed, will be dedicated to the city of Reno as public facilities within extended public right-of-way. When this happens, the privately owned 19-acre subject parcel will be divided into two portions – a southern 5.6-acre parcel containing the Sage Point Channel and a northern 13.4-acre parcel containing the Horse Creek segment.

The fourth important project constraint was defined through initial design concept meetings with the project stakeholders – including a representative from the Nevada

National Guard. As Figure 1 indicates, the 353-acre parcel situated immediately north of the subject parcel is owned by the United States of America and leased by the Nevada National Guard though the US Army Corps of Engineers (USACE). The project stakeholders were advised that project improvements proposed within this parcel would require a lengthy permit process through the USACE and might likely be time prohibitive and delayed with undue complications. Understanding this, it was decided that concept design alternatives would be limited to the north property boundary of the 19-acre subject parcel and would not extend into the Nevada National Guard parcel.

6.0 Primary Design Considerations.

The restoration alternatives were developed to address the design objectives while adhering to the project constraints in accordance with the following primary design considerations. References to the two design alternatives, Alternative 'A' and Alternative 'B' are made as needed. Plates 1, 2, and 3 provide conceptual plans and details for these alternatives.

Site Soils – For the purposes of the conceptual designs, soil properties for the Horse Creek segment under consideration were estimated from information published by the USDA Natural Resource Conservation Service (NRCS). According to the NRCS, the soil unit present at the project site is classified as sandy loams with clayey substrates[2]. The physical and engineering properties for this soil unit suggest the site soils are highly erosive and unable to resist water flow velocities exceeding 2 feet/sec (fps). As mentioned in section 3.0, the full flow capacity of the exiting Horse Creek channel section is approximately 200 cfs, which correlates to a channel flow velocity of nearly 4 fps. In the conceptual designs, flow velocities were limited to no more that 2 fps to ensure native soils could be utilized without excessive stabilization or treatment.

Municipal and Nuisance Flows – The water flowing in the Horse Creek segment under consideration comes from several sources: stormwater runoff from the Horse Creek watershed, nuisance runoff from domestic users, excess irrigation flows, and municipal wastewater effluent from the nearby Reno-Stead Water Reclamation Facility (see Figure 1). This facility discharges treated wastewater into Horse Creek upstream of the Sage Point Channel via the plant outfall channel. According to the Sanitation Engineering Division of the Reno City Public Works Department, the treatment facility is required to deliver a minimum of 490 acre-feet of effluent to sustain wetlands in Swan Lake in accordance with a multi-party agreement[3]. The facility also discharges effluent in the form of reclaimed irrigation water.

Outfall flow from the plant into Horse Creek varies throughout the year depending on the amount of flow diverted into water reuse system. According to the city of Reno, the Horse Creek discharge can range from no outfall flow to a peak daily average flow of approximately 1000 gallons/minute (gpm) or 2.2 cfs. The average daily flow into Horse Creek for years 2006 and 2007 was 524 gpm or 1.2 cfs[3]. These are annualized average daily flows and peak instantaneous flows released at any given moment throughout the day may be much larger.

For the conceptual designs, all flows in the Horse Creek segment under consideration originating from all sources other than stormwater runoff occurring during, or immediately following, a rainfall event were collectively termed "low flows." As the current channel section of Horse Creek appears to provide adequate conveyance capacity for the low flows, this feature was perpetuated with the design alternatives. For purposes of the conceptual designs of the low flow facilities, an average daily flow of 20 cfs and a maximum daily flow of 65 cfs were used. This estimate accounts for the municipal effluent and nuisance watershed flows.

Project Area Limitations – From the onset of the conceptual designs, it was clear that site constraints and limited project area would dictate the restoration alternatives. Facility length was the primary limitation. The Horse Creek segment under consideration is roughly 1,300 feet long with a flowline slope of roughly 0.4%. While this is a relatively flat slope for many engineering applications, the assumed average daily and peak daily flows of 20 cfs and 65 cfs have velocities of 1.9 fps and 2.8 fps, respectively. This makes the assumed average daily flow velocity just under the soil threshold of 2 fps for erosion and sediment transport while the assumed peak daily flow velocity is beyond the threshold. Furthermore, stormwater flows from relatively small rainfall events that generate runoff approaching the Horse Creek section capacity (200 cfs) would have highly erosive channel flow velocities of nearly 4 fps. It is evident that the low flow facility would require a slope of roughly 0.25% to maintain below threshold flow velocities.

One way to reduce flow velocities and improve channel stability is to lengthen the channel segment while maintaining the same segment beginning and ending points. For instance, if the channel could meander or include significant sinuosity between these points, the length would increase and the channel slope would decrease – thus reducing flow velocities. However, given the project area limitations and boundary constraints, only a modest increase in channel length could be achieved without altering either the segment beginning or ending points. As both alternative designs depict, a low flow channel slope of 0.25% could be achieved throughout the segment with as much sinuosity as practicable when combined with a low flow outlet pipe set at a much steeper slope (1%) at the segment end point.

Stormwater Flows – When evaluating the project objective, constraints, and design considerations, it became clear that the conceptual alternatives would take the form of flood control facilities with habitat promoting low flow features. No conceptual single stream re-alignment or channel section modifications seem to adequately address the competing interests of municipal and nuisance flow perpetuation along with stormwater flow conveyance while simultaneously minimizing channel erosion and Swan Lake sedimentation. The designs evolved into two-part systems – a low flow facility that would promote ecological habitat restoration and minimize daily erosion and sediment transport, harbored within a flood control facility that would collect sediment and dissipate large flows into a non-erosive manner at the project boundary. The conceptual solution, as shown for both alternatives, is to excavate a shallow sediment–detention basin within the 13-acre portion of the project site, include a sinuous low flow channel with a designated outlet pipe, and provide a high flow spillway to spread flows as they discharge into the Nevada National Guard parcel at the northern end of the basin.

For small rainfall events producing runoff flows in the range of the existing channel capacity (200 cfs), the detention volume and flow metering capability of the basin and outlet pipe will attenuate the flows and discharge most, if not all, of the captured stormwater via the low flow outlet pipe. That is, for frequent small rainfall events, perhaps a 2-year storm or less, stormwater entering the sediment-detention basin via Horse Creek should be discharged though the low flow outlet pipe and not crest the spillway. Conversely, for larger rainfall events producing more stormwater runoff, the proposed basin will provide only minimal peak flow attenuation and the function of the facility will transfer to sediment collection and non-erosive flow dissipation. For instance, the 100-year peak flow of 1,600 cfs anticipated for the entire Horse Creek watershed will be attenuated by the basin to approximately 1,550 cfs as it discharges in a shallow, non-erosive flow into the Nevada National Guard parcel. However, the most beneficial aspect of the basin is that it will act as a sediment forebay, trapping sediment during the large stormwater runoff events preventing significant amounts of sediment and debris from entering Swan Lake. Additionally, the planned maintenance access provisions for the basin will provide for reasonable post-event sediment and debris removal.

It should be noted that for the same 13-acre area, a detention basin capable of substantive peak 100-year peak flow attenuation would need to be more than 20-feet deep. The conceptual design for the basin is only 5-feet deep and therefore, is more representative of a sediment collection and flow spreading facility rather than a flow detention and outlet metering facility.

Nature Study Area Access – The public access from Lear Blvd. to the Swan Lake Nature Study Area is a gravel road west of, and immediately adjacent to, the Horse Creek segment under consideration (see Photo 3). In accordance with the preliminary plans for the box culvert facility proposed under Lear Blvd., this access would be disturbed. It was imperative that the conceptual designs include provisions for the perpetuation of this access from Lear Blvd. The designs propose two different access alternatives – one through the Stonefield Industrial Center (Alternative 'A') and the other through the subject parcel (Alternative 'B').

Photo 3. Swan Lake Nature Study Area access entrance (looking north).

7.0 Additional Design Considerations.

The following additional design considerations influenced the proposed restoration alternatives.

Maintenance Access – For the long-term operation and usefulness of the restoration improvements, the conceptual designs include provisions for maintenance access similar to the requirements of the city of Reno and Washoe County for public stormwater management facilities. These access features include a 15-foot wide perimeter roadway (compacted roadway base material suggested) and access ramps to the bottom of the facility at strategic locations.

Construction Budget – The stakeholders emphasized project budgetary constraints would likely govern the project feasibility and the conceptual designs. To minimize construction costs, the conceptual designs incorporated the following criteria:

1. No concrete or asphalt surfaces would be required.
2. Native soils would be utilized without substantial stabilization or treatment.

3. Underground piping would be kept to a minimum – both in facility lengths and diameters.

4. Earthwork activities for the project would maximize the potential for soil export to nearby projects requiring fill, i.e., no soil import and perhaps little to no cost for soil export.

5. Routine maintenance operations would be no more sophisticated or time consuming than an ordinary roadway culvert of public detention basin.

Recreation/Pedestrian Uses – It was recognized that the project's proximity to the Swan Lake Nature Study Area could promote additional recreation and pedestrian uses. The conceptual designs incorporate pedestrian access via the maintenance access roads and a vehicle turn-a-round area that could be used for additional parking for the nature study access.

Adjacent Property (west) – A stormwater detention/retention basin exists along the westerly boundary of the subject parcel. This facility serves the industrial developments further to the west. The conceptual designs do not incorporate this basin into the alternatives. However, it is recognized that the opportunity for combining this facility with the restoration alternatives might generate mutually beneficial results and should be carefully considered.

8.0 Concept Alternative 'A'.

Plate 1 provides a conceptual grading plan for Alternative 'A'. Plate 3 includes details of important sections within the plan. The basic premises behind the design have been outlined in design considerations of sections 6.0 and 7.0. Additional features of note include:

A. The primary access to the nature study area is relocated easterly into the Stonefield Industrial Center project. Initial conversations with that project developer indicate there is good support for this proposal. The benefit to this location is that visitors to the study are will cross Horse Creek only once using the Lear Blvd. box culvert. Another advantage is that access to the study area and the east side of the basin spillway can be maintained during and following major storm events.

B. The concept plan incorporates the proposed Lear Blvd. concrete box culvert and its apron appurtenances. Discharge from this facility will need to be deflected northwesterly as it enters the sediment-detention basin. This will be achieved by armoring the basin bank along the east side. This armoring will also ensure the relocated nature study area main access road and the Stonefield Industrial Center improvements are protected from large stormwater flows from the culvert.

C. The basin spillway surface is proposed to receive a roller compacted soil treatment (or similar) to protect it from flow velocities when active. This type of surface can be disturbed by frequent vehicular use so maintenance access to both sides of the spillway is provided. In addition, armoring is proposed on the down hill side of the spillway to reduce flow velocities and promote shallow discharge flow into the Nevada National Guard parcel. The 100-year peak discharge flow over the spillway is anticipated to occur at a non-erosive velocity of roughly 2 fps. Although elaborate hydraulic modeling of existing flow conditions is beyond the scope of work, preliminary estimates suggests a 1,600 cfs flow into the Nevada National Guard parcel (the existing condition) would produce flow velocities in excess of 4 fps.

D. An additional driveway and gated entrance for maintenance access is proposed along Lear Blvd. west of the Horse Creek crossing. This driveway is needed in addition to the relocated main access to minimize visitor vehicular traffic over the sensitive spillway surface.

E. The low flow channel will discharge back into the original Horse Creek channel via a 42-inch outlet pipe. As previously mentioned, this pipe provides for the flat low flow channel slope by taking up two vertical feet of fall across the parcel. This pipe also works as the outlet control structure for the sediment-detention basin during small runoff events. Channel bank and bottom armoring would be required in the original Horse Creek channel at the point where the outlet pipe discharges. The remainder of original Horse Creek channel, from this point downstream, will not be modified by this project.

F. A vehicle turn-a-round area is proposed along the western basin bank for maintenance vehicles. This location can slide along the basin edge and might be more practical located closer to the basin spillway. This turn-a-round will allow maintenance vehicles to back away from the spillway and avoid disturbing the spillway surface soils or crossing over the spillway during storm events.

G. The low flow channel is designed to allow sediment within the municipal and nuisance flows to drop out of solution and settle within the basin before entering Swan Lake. For the assumed average daily flow of 20 cfs, the anticipated flow depth in this channel will be 0.5-feet with non-erosive flow velocity of 1.9 fps. For the assumed peak daily municipal and nuisance flow of 65 cfs, the anticipated flow depth in the low flow channel will be 1-ft with a flow velocity of 2.8 fps. This velocity is potentially erosive but assumed to occur perhaps once per day for a short duration.

The low flow channel is planned to meander through the basin bottom – developing additional channel segment length to minimize channel slope. It is possible this mild channel sinuosity will be stable and perpetuated. However, it is also possible that the first large storm event flow through the basin will abolish the channel shape and perhaps form a braided channel system or a shallow pooling wetland feature in the basin bottom. The conceptual design objective for the low flow channel was to give the system an initial shape and form and then let natural soil-water interactions and storm events form and reform the facility within the protective confines of the sediment-detention basin. For maintenance considerations, it is envisioned that debris will be removed within the path of the low flow channel and sediment will be removed at the low flow outlet pipe entrance, the box culvert exit, and at the base of the basin spillway.

H. One disadvantage to this alternative is that the proposed locations of the main nature study access driveway and the westerly most driveway proposed for the Stonefield Industrial Center will not meet the city of Reno minimum spacing standards. However, it is assumed the special nature of this facility will warrant an exception to the standards. The proposed maintenance access driveway should not complicate this issue as it is proposed to be gated. Another disadvantage to this alternative is that the access is completely dependent upon the cooperation of the adjacent development and the proposed box culvert under Lear Blvd. This concern is addressed with the second restoration alternative.

9.0 Concept Alternative 'B'.

Initially it was hoped that a significantly different alternative could be proposed for Alternative 'B' – however, due to the specific set of project goals, design objectives, and site constraints, a substantially different restoration design was not formulated. Instead, the second alternative was developed to address the primary uncertainty of Alternative 'A' – mainly, site access. Alternative 'B' was formulated to answer the question; how could the main design concept be modified if cooperation from the Stonefield Industrial Center waned or if that project and the proposed box culverts were never constructed? To resolve this concern, a new main access was combined with the previously discussed new maintenance access.

Unlike the first alternative, Alternative 'B' requires an on-site crossing of Horse Creek. Adhering to the budgetary considerations for the project, a simple depressed crossing is proposed along the sediment-detention basin bottom. To allow safe traverse when Horse Creek is inundated by peak daily municipal and nuisance flows, as well as routine small stormwater runoffs, the crossing requires a low flow underpass. A complication with this approach is that the crossing will likely be unsafe during large runoff events in the creek. In such events, access to the spillway would still be provided by the perimeter maintenance road but if the spillway was active, there would likely be no access to the nature study area until waters receded.

One advantage to this alternative is that the proposed access driveway would meet city of Reno minimum spacing requirements in relation to the proposed Stonefield Industrial Center driveways . Additionally, this alternative includes slightly less excavation and could generate a small initial sediment forebay just upstream of the internal stream crossing – a redundant feature for the system. However, this redundancy could generate additional maintenance efforts and the internal crossing itself would cost more to construct and require significantly more routine maintenance.

10.0 Conclusions.

There are likely other alternatives that meet some or most of the project goals, design objectives, and site constraints – this was not an exhaustive analysis. It is clear Alternative 'A' includes advantages and minimizes disadvantages that Alternative 'B' does not. Alternative 'B' could be considered a fall-back concept should corporation or proposed projects stall. The opportunity to incorporate the existing detention/retention basin facility within the parcel to the west should be carefully considered. Mutually beneficial outcomes could be realized through a combined system.

The hydraulic calculations used in the conceptual design are of the most routine and fundamental kind. Normal depth calculations were utilized for flow velocity and depth estimations, triangular runoff hydrographs were used to estimate peak runoff characteristics and volumes, and spreadsheet driven storage-indication or Puls Method was used for the detention basin inflow-outflow hydrologic routing. Subsequent designs and detailed analyses should include more comprehensive approaches and sophisticated methodologies to examine the existing and proposed conditions surrounding restoration alternatives.

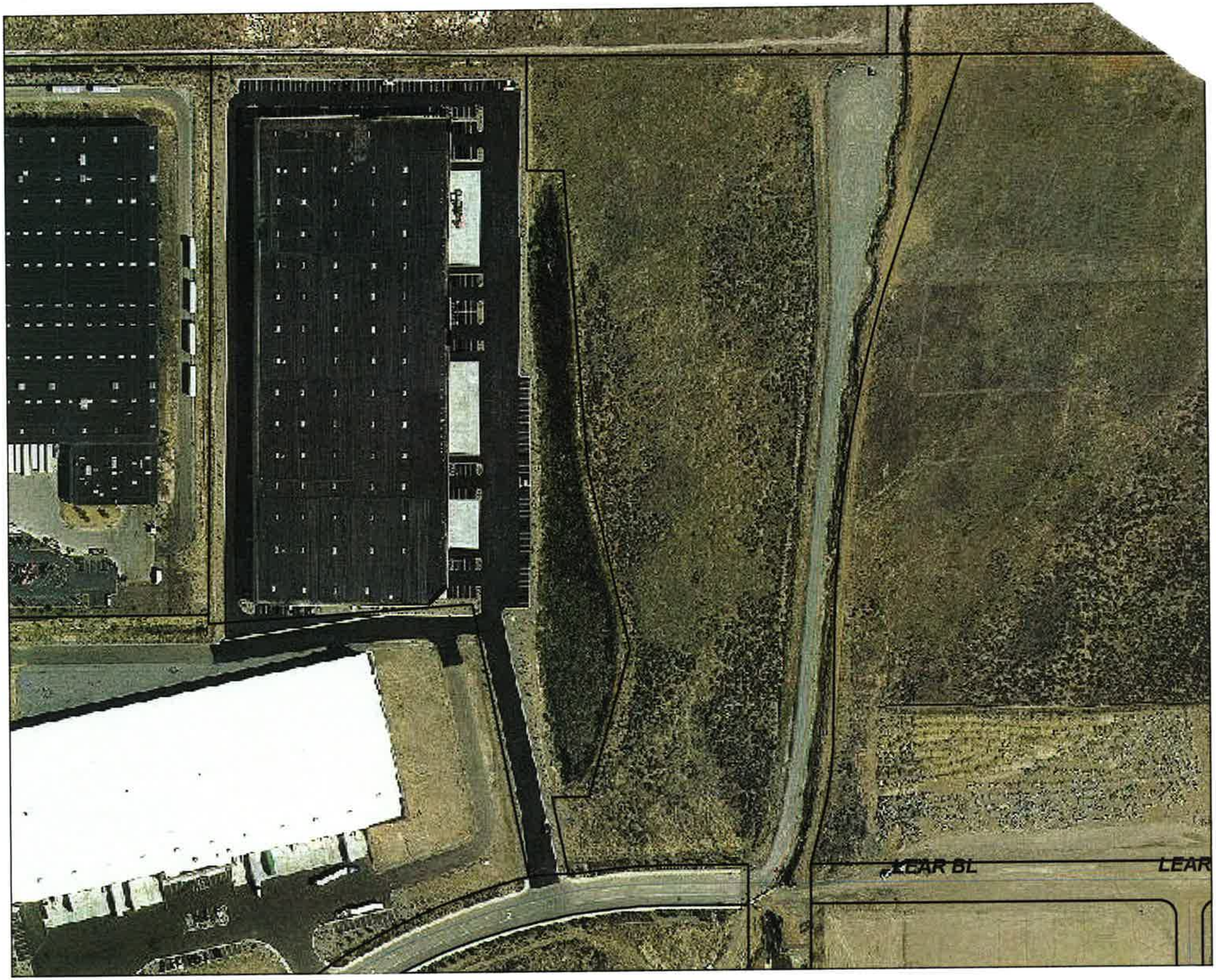
No mention of future facility ownership or maintenance responsibilities is included in this report. At this time, the subject parcel is privately owned and most likely a public agency or entity would need to operate and maintain the facility. The completed facility would serve the greater public good by promoting an ecologically beneficial discharge of municipal and regional nuisance waters and by safely conveying stormwater runoff from the entire Horse Creek watershed.

References Cited.

1. Schaaf & Wheeler, Consulting Civil Engineers, *Lemmon Valley Master Hydrology, Reno Nevada.* March 2005.

2. Natural Resource Conservation Service, *Web Soil Survey 2.0 – National Cooperative Soil Survey, Washoe County, Nevada, South Part.* 11/2/2007.

3. Personal communication from Mr. Michael Drinkwater and Mr. Stan Shumaker of the Reno City Public Works Department on October 25, 2007.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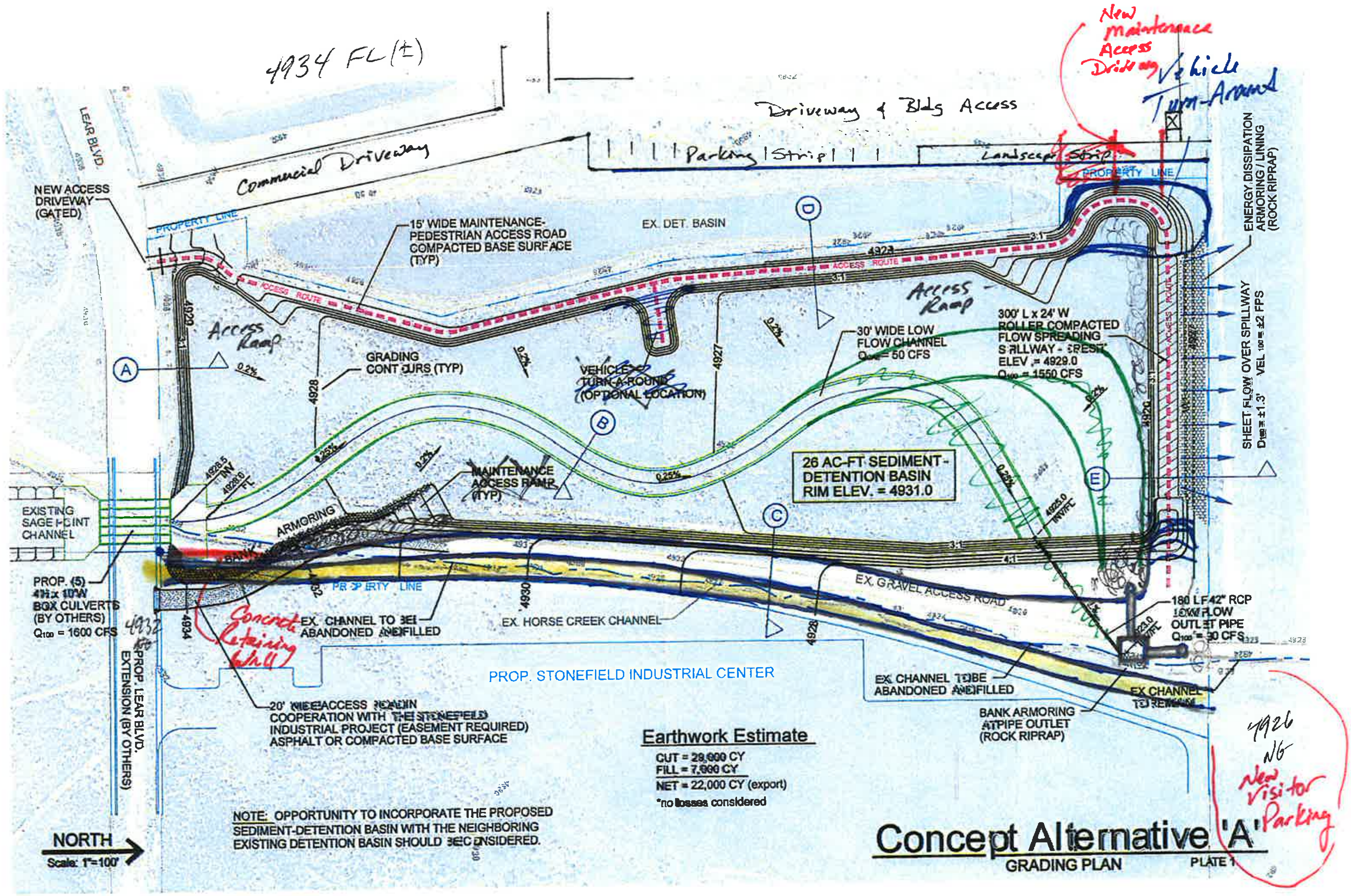
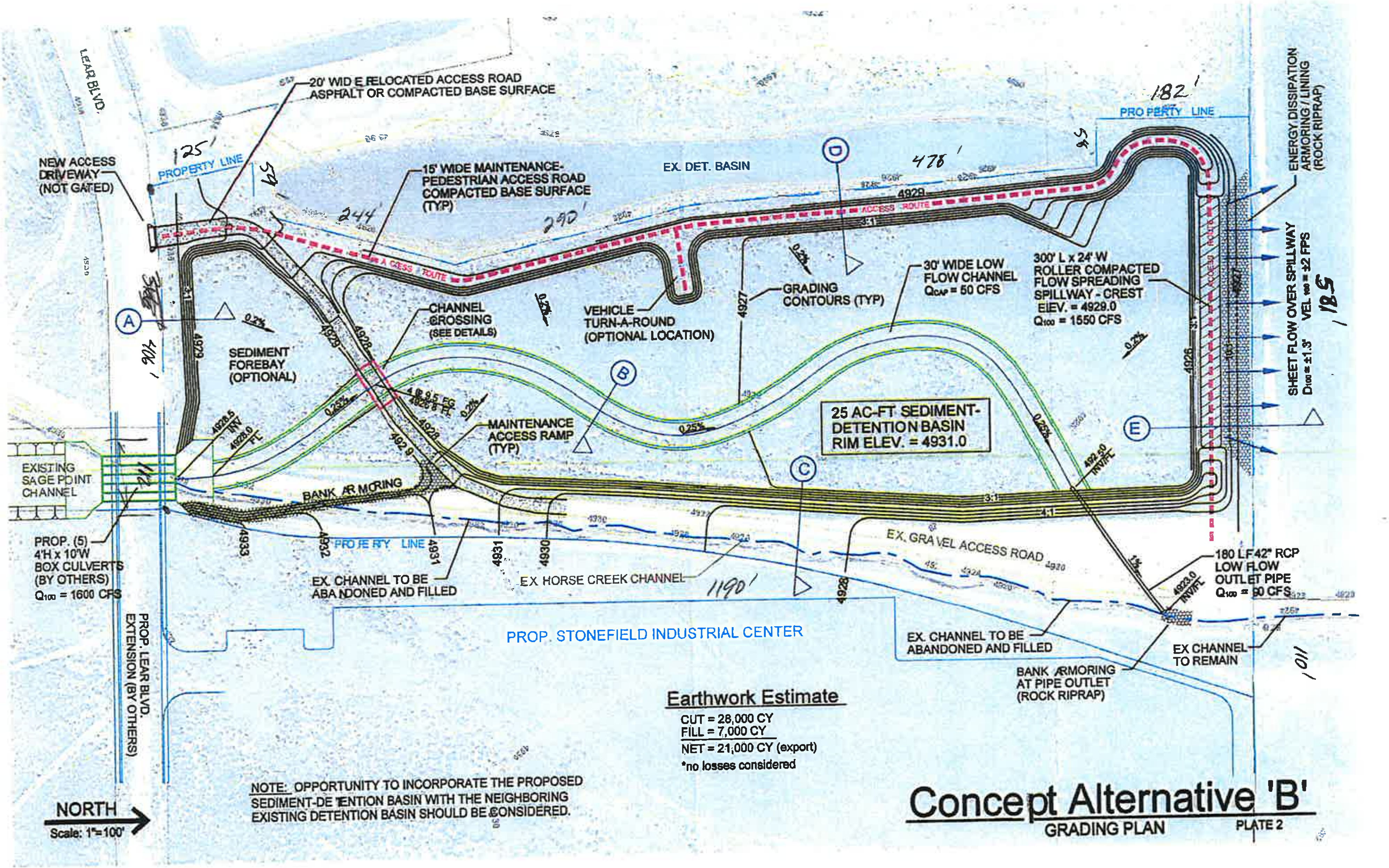
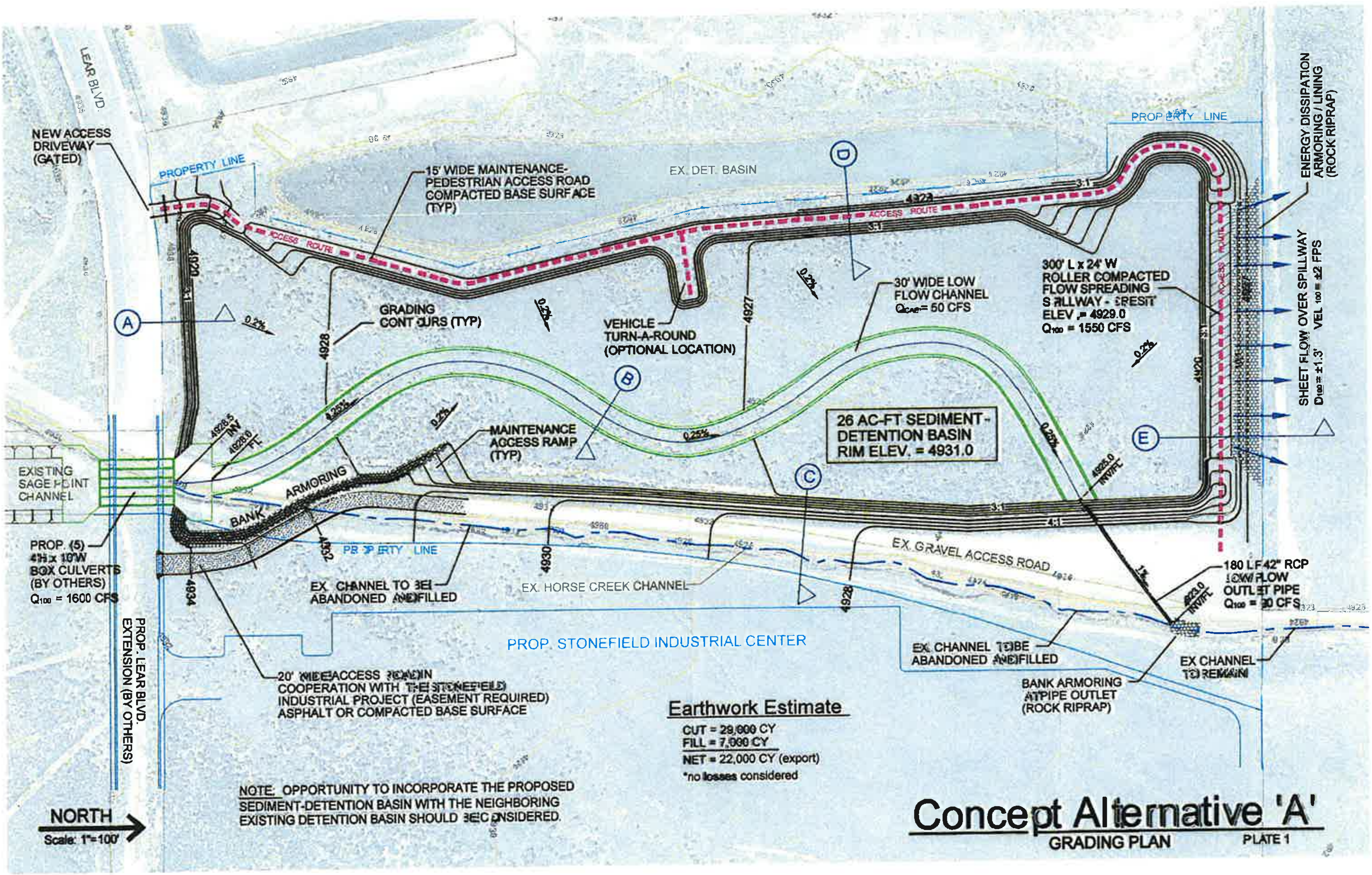


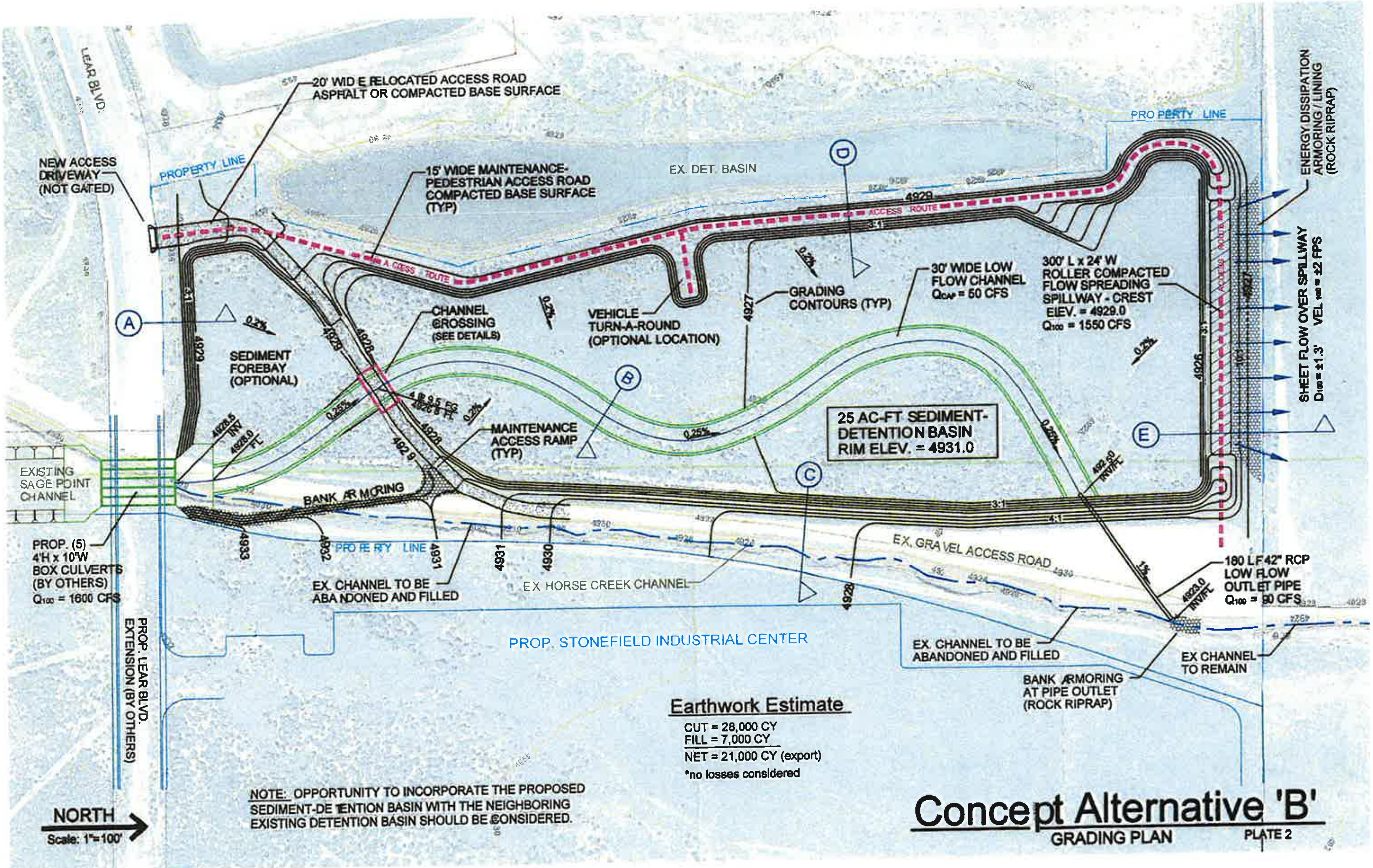
4934 FL(±)
New maintenance Access Driveway
Vehicle Turn-Around
Driveway & Bldg Access
Commercial Driveway
Parking Strip
Landscape Strip
PROPERTY LINE
LEAR BLVD.
NEW ACCESS DRIVEWAY (GATED)
15' WIDE MAINTENANCE-PEDESTRIAN ACCESS ROAD COMPACTED BASE SURFACE (TYP)
EX. DET. BASIN
ACCESS ROUTE
ENERGY DISSIPATION ARMORING / LINING (ROCK RIPRAP)
Access Ramp
GRADING CONTOURS (TYP)
VEHICLE TURN-A-ROUND (OPTIONAL LOCATION)
30' WIDE LOW FLOW CHANNEL Q100 = 50 CFS
300' L x 24' W ROLLER COMPACTED FLOW SPREADING SPILLWAY - CREST ELEV. = 4929.0 Q100 = 1550 CFS
SHEET FLOW OVER SPILLWAY D100 = ±1.3' VEL 100 = ±2 FPS
26 AC-FT SEDIMENT-DETENTION BASIN RIM ELEV. = 4931.0
MAINTENANCE ACCESS RAMP (TYP)
ARMORING
EXISTING SAGE POINT CHANNEL
PROP. (5) 4'H x 10'W BOX CULVERTS (BY OTHERS) Q100 = 1600 CFS
Concrete Retaining Wall
EX. CHANNEL TO BE ABANDONED AND FILLED
EX. HORSE CREEK CHANNEL
EX. GRAVEL ACCESS ROAD
180 LF 42" RCP LOW FLOW OUTLET PIPE Q100 = 30 CFS
EX. CHANNEL TO BE ABANDONED AND FILLED
EX. CHANNEL TO REMAIN
BANK ARMORING AT PIPE OUTLET (ROCK RIPRAP)
PROP. STONEFIELD INDUSTRIAL CENTER
PROP. LEAR BLVD. EXTENSION (BY OTHERS)
20' WIDE ACCESS ROAD IN COOPERATION WITH THE STONEFIELD INDUSTRIAL PROJECT (EASEMENT REQUIRED) ASPHALT OR COMPACTED BASE SURFACE
Earthwork Estimate
CUT = 29,000 CY
FILL = 7,000 CY
NET = 22,000 CY (export)
*no losses considered
NOTE: OPPORTUNITY TO INCORPORATE THE PROPOSED SEDIMENT-DETENTION BASIN WITH THE NEIGHBORING EXISTING DETENTION BASIN SHOULD BE CONSIDERED.
4926 NG
New Visitor Parking
4932
4934
NORTH
Scale: 1"=100'
Concept Alternative 'A'
GRADING PLAN
PLATE 1



LEAR BLVD.
20' WIDE RELOCATED ACCESS ROAD
ASPHALT OR COMPACTED BASE SURFACE
NEW ACCESS
DRIVEWAY
(NOT GATED)
PROPERTY LINE
15' WIDE MAINTENANCE-
PEDESTRIAN ACCESS ROAD
COMPACTED BASE SURFACE
(TYP)
EX. DET. BASIN
ACCESS ROUTE
PROPERTY LINE
ENERGY DISSIPATION
ARMORING / LINING
(ROCK RIPRAP)
SEDIMENT
FOREBAY
(OPTIONAL)
CHANNEL
CROSSING
(SEE DETAILS)
VEHICLE
TURN-A-ROUND
(OPTIONAL LOCATION)
GRADING
CONTOURS (TYP)
30' WIDE LOW
FLOW CHANNEL
Q_CAP = 50 CFS
300' L x 24' W
ROLLER COMPACTED
FLOW SPREADING
SPILLWAY - CREST
ELEV. = 4929.0
Q100 = 1550 CFS
SHEET FLOW OVER SPILLWAY
D100 = ±1.3' VEL 100 = ±2 FPS
MAINTENANCE
ACCESS RAMP
(TYP)
25 AC-FT SEDIMENT-
DETENTION BASIN
RIM ELEV. = 4931.0
EXISTING
SAGE POINT
CHANNEL
BANK ARMORING
PROP. (5)
4'H x 10'W
BOX CULVERTS
(BY OTHERS)
Q100 = 1600 CFS
PROPERTY LINE
EX. CHANNEL TO BE
ABANDONED AND FILLED
EX. HORSE CREEK CHANNEL
EX. GRAVEL ACCESS ROAD
180 LF 42" RCP
LOW FLOW
OUTLET PIPE
Q100 = 90 CFS
PROP. LEAR BLVD.
EXTENSION (BY OTHERS)
PROP. STONEFIELD INDUSTRIAL CENTER
EX. CHANNEL TO BE
ABANDONED AND FILLED
EX CHANNEL
TO REMAIN
BANK ARMORING
AT PIPE OUTLET
(ROCK RIPRAP)
Earthwork Estimate
CUT = 28,000 CY
FILL = 7,000 CY
NET = 21,000 CY (export)
*no losses considered
NOTE: OPPORTUNITY TO INCORPORATE THE PROPOSED
SEDIMENT-DETENTION BASIN WITH THE NEIGHBORING
EXISTING DETENTION BASIN SHOULD BE CONSIDERED.
NORTH
Scale: 1"=100'
Concept Alternative 'B'
GRADING PLAN
PLATE 2



LEAR BLVD.
NEW ACCESS DRIVEWAY (GATED)
PROPERTY LINE
15' WIDE MAINTENANCE-PEDESTRIAN ACCESS ROAD COMPACTED BASE SURFACE (TYP)
EX. DET. BASIN
ACCESS ROUTE
PROPERTY LINE
ENERGY DISSIPATION ARMORING / LINING (ROCK RIPRAP)
300' L x 24' W ROLLER COMPACTED FLOW SPREADING SPILLWAY - CREST ELEV. = 4929.0
Q100 = 1550 CFS
SHEET FLOW OVER SPILLWAY
D100 = ±1.3' VEL 100 = ±2 FPS
30' WIDE LOW FLOW CHANNEL
QCAP = 50 CFS
GRADING CONTOURS (TYP)
VEHICLE TURN-A-ROUND (OPTIONAL LOCATION)
MAINTENANCE ACCESS RAMP (TYP)
26 AC-FT SEDIMENT-DETENTION BASIN
RIM ELEV. = 4931.0
EXISTING SAGE POINT CHANNEL
BANK ARMORING
PROP. (5) 4'H x 10'W BOX CULVERTS (BY OTHERS)
Q100 = 1600 CFS
PROPERTY LINE
EX. CHANNEL TO BE ABANDONED AND FILLED
EX. HORSE CREEK CHANNEL
EX. GRAVEL ACCESS ROAD
180 LF 42" RCP LOW FLOW OUTLET PIPE
Q100 = 30 CFS
PROP. LEAR BLVD. EXTENSION (BY OTHERS)
PROP. STONEFIELD INDUSTRIAL CENTER
EX. CHANNEL TO BE ABANDONED AND FILLED
EX CHANNEL TO REMAIN
BANK ARMORING AT PIPE OUTLET (ROCK RIPRAP)
20' WIDE ACCESS ROAD IN COOPERATION WITH THE STONEFIELD INDUSTRIAL PROJECT (EASEMENT REQUIRED) ASPHALT OR COMPACTED BASE SURFACE
Earthwork Estimate
CUT = 29,000 CY
FILL = 7,000 CY
NET = 22,000 CY (export)
*no losses considered
NOTE: OPPORTUNITY TO INCORPORATE THE PROPOSED SEDIMENT-DETENTION BASIN WITH THE NEIGHBORING EXISTING DETENTION BASIN SHOULD BE CONSIDERED.
NORTH
Scale: 1"=100'
Concept Alternative 'A'
GRADING PLAN
PLATE 1



Earthwork Estimate

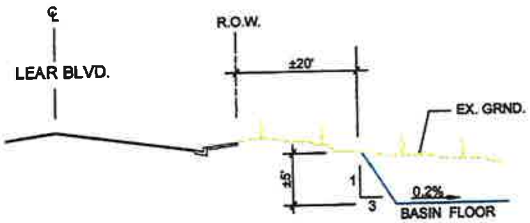
CUT = 28,000 CY
FILL = 7,000 CY
NET = 21,000 CY (export)
*no losses considered

NOTE: OPPORTUNITY TO INCORPORATE THE PROPOSED SEDIMENT-DETENTION BASIN WITH THE NEIGHBORING EXISTING DETENTION BASIN SHOULD BE CONSIDERED.

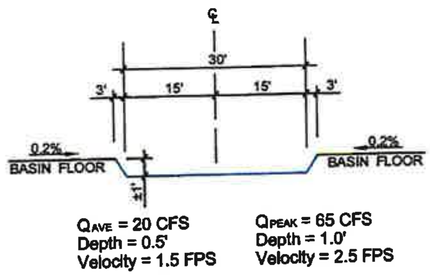
Concept Alternative 'B'

GRADING PLAN

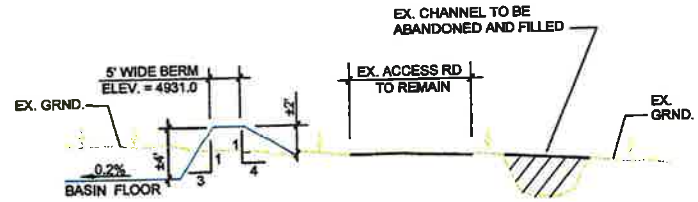
PLATE 2



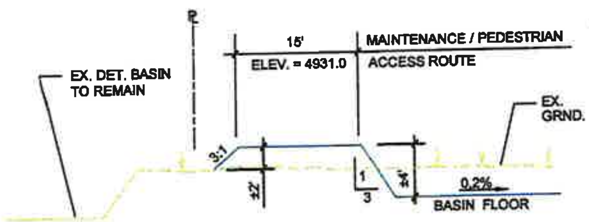
(A) Lear Blvd. Section
NO SCALE



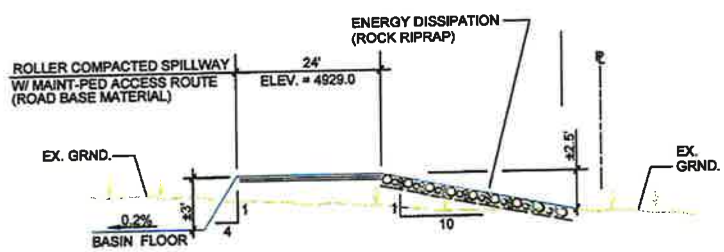
(B) Low Flow Channel Section
NO SCALE



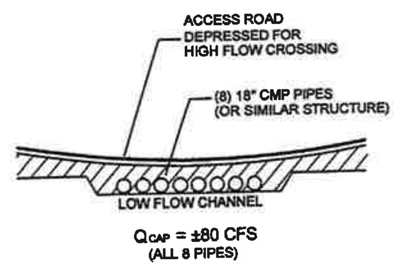
(C) Ex. Access Road Section
NO SCALE



(D) Ex. Det. Basin / Access Route Section
NO SCALE



(E) Det. Basin Spillway Section
NO SCALE



Channel Crossing Detail
FOR ALTERNATIVE 'B'
NO SCALE

Concept Alternatives

SECTIONS / DETAILS
PLATE 3

Stan Shumaker - Fwd: Re: warehouse property in Stead adjacent to flood channel

From: Greg Dennis
To: Drinkwater, Michael; Shumaker, Stan
Date: 3/5/2009 3:40 PM
Subject: Fwd: Re: warehouse property in Stead adjacent to flood channel

'fyi

>>> Anne Debolt 3/5/09 9:28 AM >>>
All:

Pam Parenti was our contact with Lennar Homes (she was laid off a couple of weeks age) and is the current president of the NNBA phone number 329-4611. Pam and Dustin Barker (825-7733 - the remaining acquisition person for Lennar) called yesterday.

I asked him to provide three preliminary title reports:
1. APN 568-041-01, the property being considered for acceptance by the City, with the flood channel running through it;
2. the industrial property to the East - APN 568-100-09 which has been sold to Stonefield Industrial; and
3. APN 568-110-04 which indicates the Lennar owned streets in the undeveloped subdivision.

The key points:

1. Lennar must provide legal public access to the industrial property. Currently, Lear Blvd, which has been built up to the Northeast line of APN 568-032-02, is the only public access to the property.
2. The portion of Lear Blvd over and East of the flood channel is just a dirt road. However, East of the flood channel, Lear Blvd is part of a larger system of streets (APN 568-110-04) owned by Lennar which have not yet been developed or accepted by the City - so they are not considered legal public access.
3. During our conversation, Pam said that Lennar is not planning to "give" the City the entire parcel (568-041-01), just the portion to the South of Lear Blvd (the channel). Lennar plans to give the flat portion to the North of Lear Blvd to the Swan Lake Advisory Board(?). Evidently there is a proposed map being prepared to show this change.

My suggestions are:

1. Wait for the preliminary title reports to see if any factors affecting the properties come to light.
2. Request a copy of the new map from Lennar.
3. Determine exactly what property Lennar is planning to dedicate to the City. I don't believe that SLAB is an entity which can receive title to real property - unless they mean the County.

4. Determine whether the City wants to accept only the flood channel.
5. Require Lennar to develop and dedicate the Easterly portion of Lear Blvd to provide legal access to APN 568-100-09.
6. Require Lennar to repair and replace the culverts under Lear Blvd for the flood channel property Lennar wants to dedicate to the City before it is accepted.

If you have any questions, please give me a call. I have hard copies of all the maps and the county ownership records - let me know if you want a copy.

Anne

Anne DeBolt, SR/WA
Property Program Manager
City of Reno - Public Works

775-334-3812 (P)
775-334-2490 (F)
775-830-9932 (C)

>>> Stan Shumaker 2/25/2009 6:20 PM >>>
Anne,
At a meeting a few weeks ago you stated that the property (APN 568-100-09) purchased for warehouse development at the east end of Lear Blvd in Stead more than likely is entitled to an access to Lear Blvd. You offered to check the transfer of ownership records (from Lennar to Panattoni Development Company - Stonefield Industrial Center) to determine if this is true.

The only available access to the warehouse property from the east end of the paved section of Lear Blvd is a dirt road (built by parties unknown) which crosses a flood channel. This dirt road, built over a small culvert pipe placed in the channel, very effectively prevents the flood channel from conveying its design flood flow.

The question of access from Lear is related to whether or not the City of Reno should or may take ownership of the flood channel and the adjoining vacant land west of the warehouse property, currently owned by Lennar (APN 568-041-01), with this make-shift channel crossing in place. You indicated that the dirt road crossing the channel may need to be perpetuated for the benefit of the warehouse property.

You also indicated that if the channel and the road crossing are privately owned, then the access that the road provides to the warehouse property remains private and the problems that the road causes in terms of upkeep and flood issues remains a private concern.

Stan Shumaker
Sr. Civil Engineer
334-3309


02/01/2007


02/01/2007


02/01/2007


02/01/2007


STOP
Cam
02/01/2007


02/01/2007


07/17/2006


SCHMIDT
07/17/2006


07/17/2006


02/01/2007


02/01/2007


WILD 15/4 UAG
2722


5-19-95
WILD 15/4 UAG
2722
RENO


WILD 15/4 UAG
2722

WILD 15/4 UAG
2722
19-95
1"=3390'±

WILD 15/4 UAG
2722

Stonefield Channel (6-9-06) 6-16-09
1:30 CI Mtg

List of Concerns from Joe, Keri, Erich.

Leave crossing as is / access for Lennar construction.
reconstruct for low water x-ing
w/ reinforcement for high water wash-out prevention.

Propex Mat

Hydro Seed

Signs — No Vehicles
Revegetation Project

City needs to engineer a solution for permanent

City asked for 2 parcels to allow Lennar to dedicate channel to City.

Redesign channel bottom

Rolling Stock Permit — does State have copy w/ removal required.

March 7, 2005

Attn:
City of Reno, Public Works Department
P.O. Box 1900
Reno, Nevada 89505

RE: SAGE POINT CHANNEL COOPERATIVE CONSTRUCTION AGREEMENT

Dear Mr. -----:

Lennar Reno LLC., (Lennar) is committed to a cooperative construction effort with the City of Reno (City) for the Sage Point Channel (channel). The following is a proposed outline of tasks and responsibilities for each of the parties in order to insure the coordination and construction of the channel.

- Lennar to prepare/provide a master hydrology report for the area that includes the Sage Point Channel.
- The City to prepare and provide to Lennar typical cross sections based upon the hydraulics of the channel and the hydrology provided. The cross section to include dimension, armoring, planting, low flow channels, and access.
- Lennar to prepare preliminary plans in accordance with the cross-section provided.
- Lennar to prepare and process a Special Use Permit (SUP), with the City being the applicant **[fees? Can the city be the applicant]** CHANNEL ONLY?
- The City and Lennar will jointly and corporately process the SUP through the governing entities to obtain approval of the SUP.
- The City and Lennar will work together to obtain reasonable conditions associated with the SUP.
- Lennar will prepare a final set of improvement drawing in accordance the conditions of the SUP.
- Lennar to coordinate with the City on the planting and irrigation design and incorporate the City's design into final plans.
- Lennar to submit finals plans to the City for site permit **[bonding and inspection fees? Lennar only for grading city for the rest?]**
- Lennar to rough grade the channel and remove material from the site in accordance with the final plans at their costs.

- The City to complete landscaping, irrigation, armoring, path and meandering low flow channel in accordance with final plan at their costs.
- The City to obtain final release of the site permit and bonds.
- The Landowner to dedicate land/parcel to the City of Reno.

Lennar Reno LLC, appreciates this opportunity to work with the City of Reno in this cooperative effort to enhance the Sage Point Channel. If you should have any questions, please feel free to contact us.

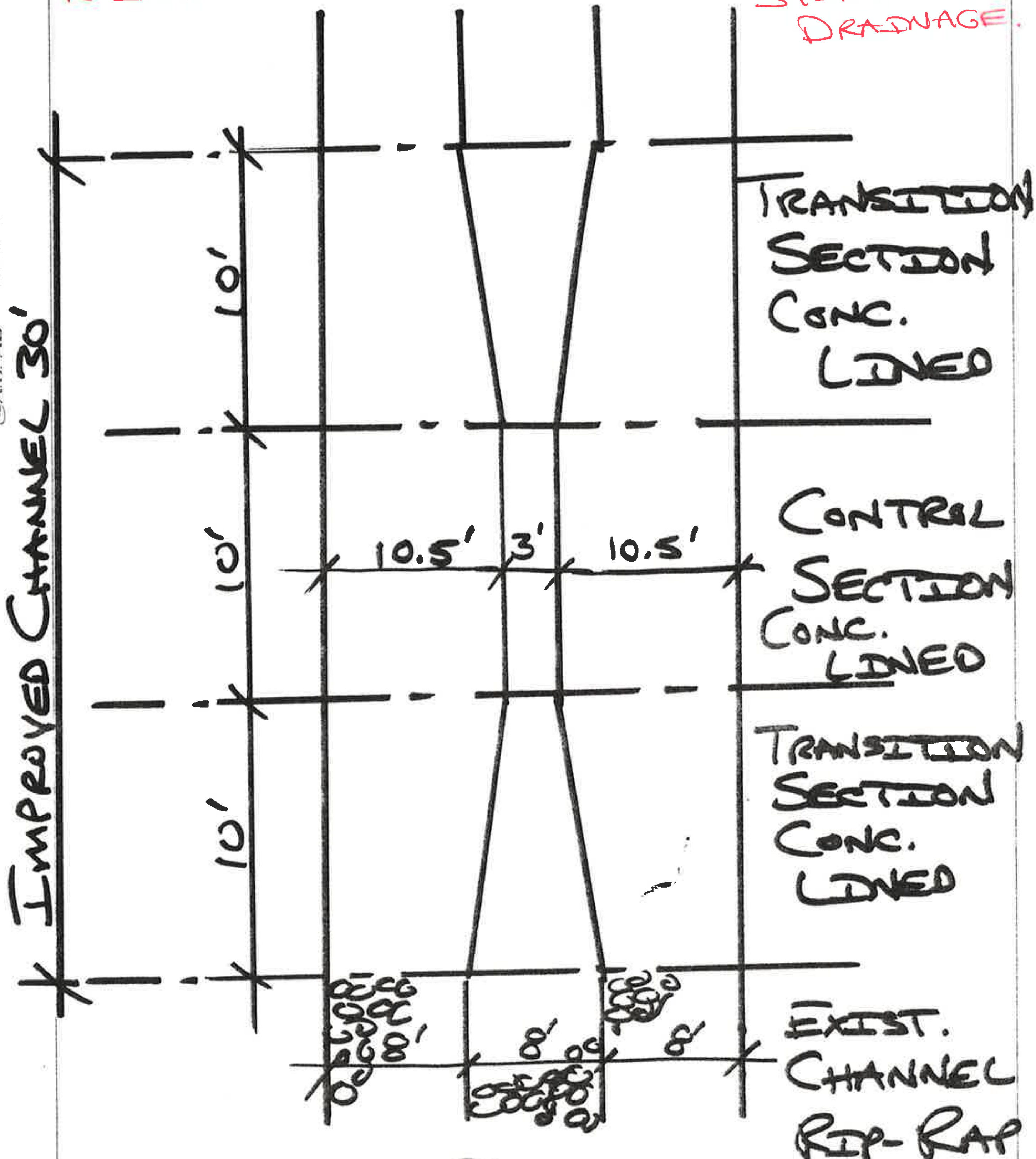
Sincerely,

-------------------.

EXTENSION OF WSE @ SWAN LAKE ?
WASHOE COUNTY PARKS INTERFACE
THEY INTEND TO KEEP & UTILIZE ALL HARVESTED MATERIALS.
SEGMENTAL ?
NATURAL VS DEVELOPED LANDSCAPE
OTHER AGENCY COORDINATION..
TIMING
VECTOR
WATER BALANCE
2 MGD FROM PLANT. - TYPICAL FLOW RATE? BASE FLOW? MAX FLOW RATE
CROSSINGS ?
100 YR W/ FUTURE DEVELOPMENT.
WATER QUALITY
#1 MAINTAINABILITY

A) SCOPE
B) GEOMORPH
C) INTERLOCAL COORDINATION
D) DOLLARS (IF GRANT)
E) LONG TERM MAINTENANCE.

Moody,
This is a concept level plan I discussed w/ Jeanette for the stream gauge control section to incorporate in our HEC-RAS model for Stead Drainage.



STEAD STP DRAINAGE CONTROL SECTION

JD
1/11/05

EXISTING CHANNEL

Trapezoidal Channel - Normal Depth

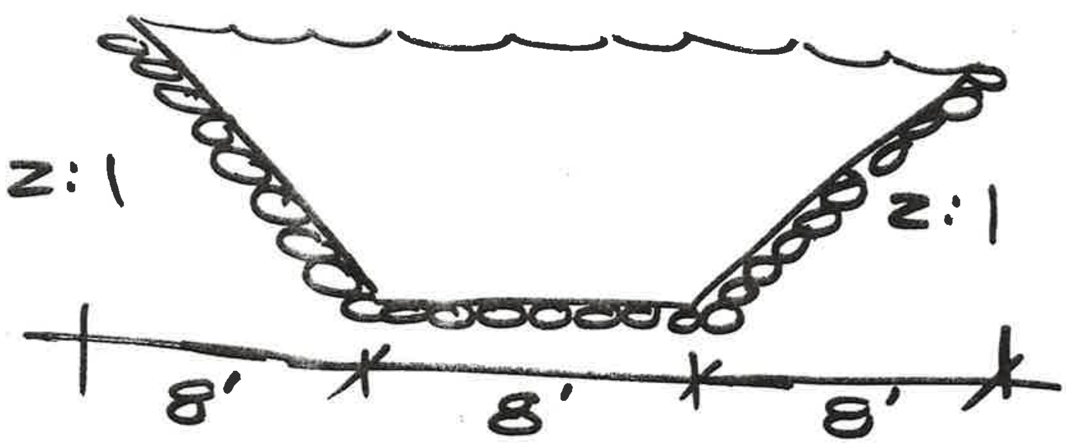
Flow Rate:	400	cfs	Left Side Slope:	0.5	ft/ft
Bottom Slope:	0.023	ft/ft	Right Side Slope:	0.5	ft/ft
Manning's N-Value:	0.04 Select		Bottom Width:	8	ft

Normal Depth:	4.00	ft
Flow Velocity:	9.99	fps
Froude Number:	0.964	
Velocity Head:	1.55	ft
Energy Head:	5.55	ft
Cross-Sectional Area of Flow:	40.04	sq ft
Top Width of Flow:	12.00	ft

RIP-RAP

N-VALUE = 0.040

AVG. SLOPE = 2.3%



Critical Depth | Normal Depth | Rating Curve | Water Surface Profile

0.0001 to 1

start HYDROCALC HYDRA... 2:49 PM

BEGIN TRANSITION CHANNEL

HYDROCALC HYDRAULICS

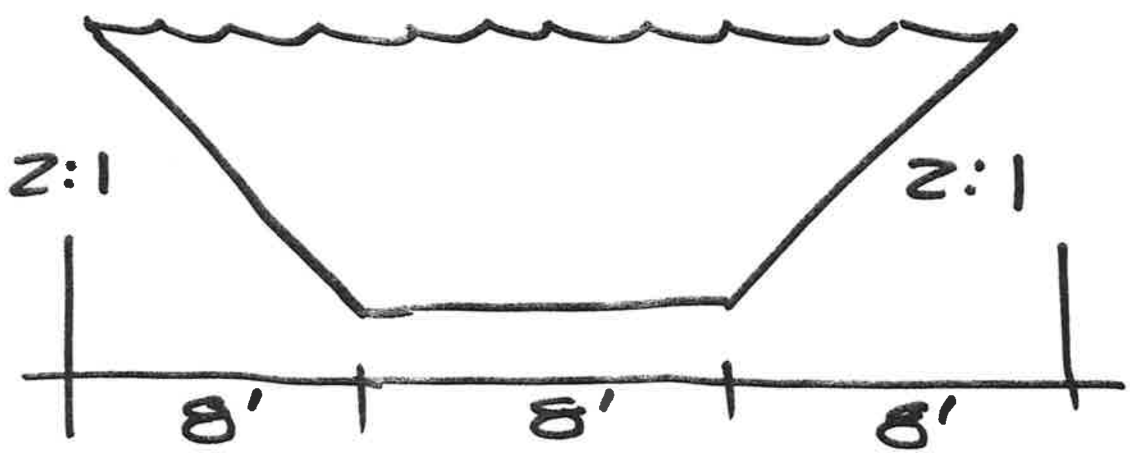
File Structures View Options Help

Trapezoidal Channel - Normal Depth

Flow Rate:	800	cfs	Left Side Slope:	0.5	ft/ft
Bottom Slope:	0.023	ft/ft	Right Side Slope:	0.5	ft/ft
Manning's N-Value:	0.019 Select		Bottom Width:	8	ft

Normal Depth:	3.88	ft
Flow Velocity:	20.74	fps
Froude Number:	2.029	
Velocity Head:	6.68	ft
Energy Head:	10.56	ft
Cross-Sectional Area of Flow:	38.58	sq ft
Top Width of Flow:	11.88	ft

CONCRETE LINED
N-VALUE = 0.019
(PUB. WORKS DES. MAN.)



Critical Depth | Normal Depth | Rating Curve | Water Surface Profile

0.0001 to 1

start HYDROCALC HYDRA... 3:30 PM

CONTROL SECTION 20-CFS

HYDROCALC HYDRAULICS

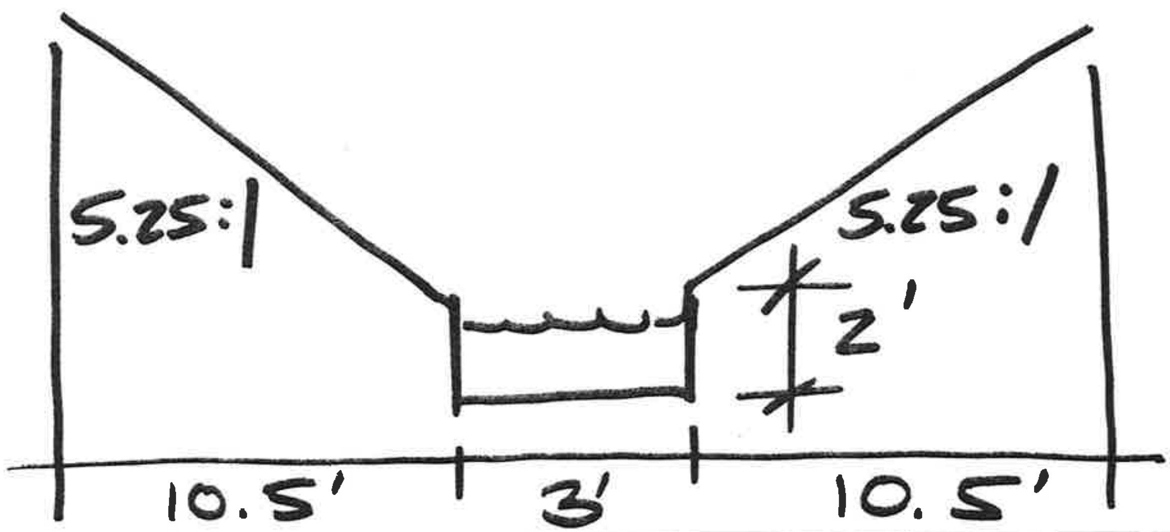
File Structures View Options Help

Trapezoidal Channel - Normal Depth

Flow Rate:	20	cfs	Left Side Slope:	0	ft/ft
Bottom Slope:	0.023	ft/ft	Right Side Slope:	0	ft/ft
Manning's N-Value:	0.019 Select		Bottom Width:	3	ft

Normal Depth:	0.85	ft
Flow Velocity:	7.88	fps
Froude Number:	1.510	
Velocity Head:	0.96	ft
Energy Head:	1.81	ft
Cross-Sectional Area of Flow:	2.54	sq ft
Top Width of Flow:	3.00	ft

DEPTH IN CONTROL SECTION = 0.85'



Critical Depth | Normal Depth | Rating Curve | Water Surface Profile

0 to 100

start HYDROCALC HYDRA... 3:40 PM

CONTROL SECTION 10-CFS

HYDROCALC HYDRAULICS

File Structures View Options Help

Trapezoidal Channel - Normal Depth

Flow Rate:	10	cfs	**Left Side Slope:**	0	ft/ft
Bottom Slope:	0.023	ft/ft	**Right Side Slope:**	0	ft/ft
Manning's N-Value:	0.019 Select		**Bottom Width:**	3	ft

Normal Depth:	0.53	ft
Flow Velocity:	6.33	fps
Froude Number:	1.538	
Velocity Head:	0.62	ft
Energy Head:	1.15	ft
Cross-Sectional Area of Flow:	1.58	sq ft
Top Width of Flow:	3.00	ft

DEPTH IN CONTROL SECTION = 0.53'

Critical Depth | Normal Depth | Rating Curve | Water Surface Profile

0.0001 to 1

start HYDROCALC HYDRA... 3:41 PM

CONTROL SECTION 0.25-CFS

HYDROCALC HYDRAULICS

File Structures View Options Help

Trapezoidal Channel - Normal Depth

Flow Rate:	0.25	cfs	Left Side Slope:	0	ft/ft
Bottom Slope:	0.023	ft/ft	Right Side Slope:	0	ft/ft
Manning's N-Value:	0.019 Select		Bottom Width:	3	ft

Normal Depth:	0.05	ft
Flow Velocity:	1.63	fps
Froude Number:	1.274	
Velocity Head:	0.04	ft
Energy Head:	0.09	ft
Cross-Sectional Area of Flow:	0.15	sq ft
Top Width of Flow:	3.00	ft

DEPTH IN CONTROL SECTION = 0.05'

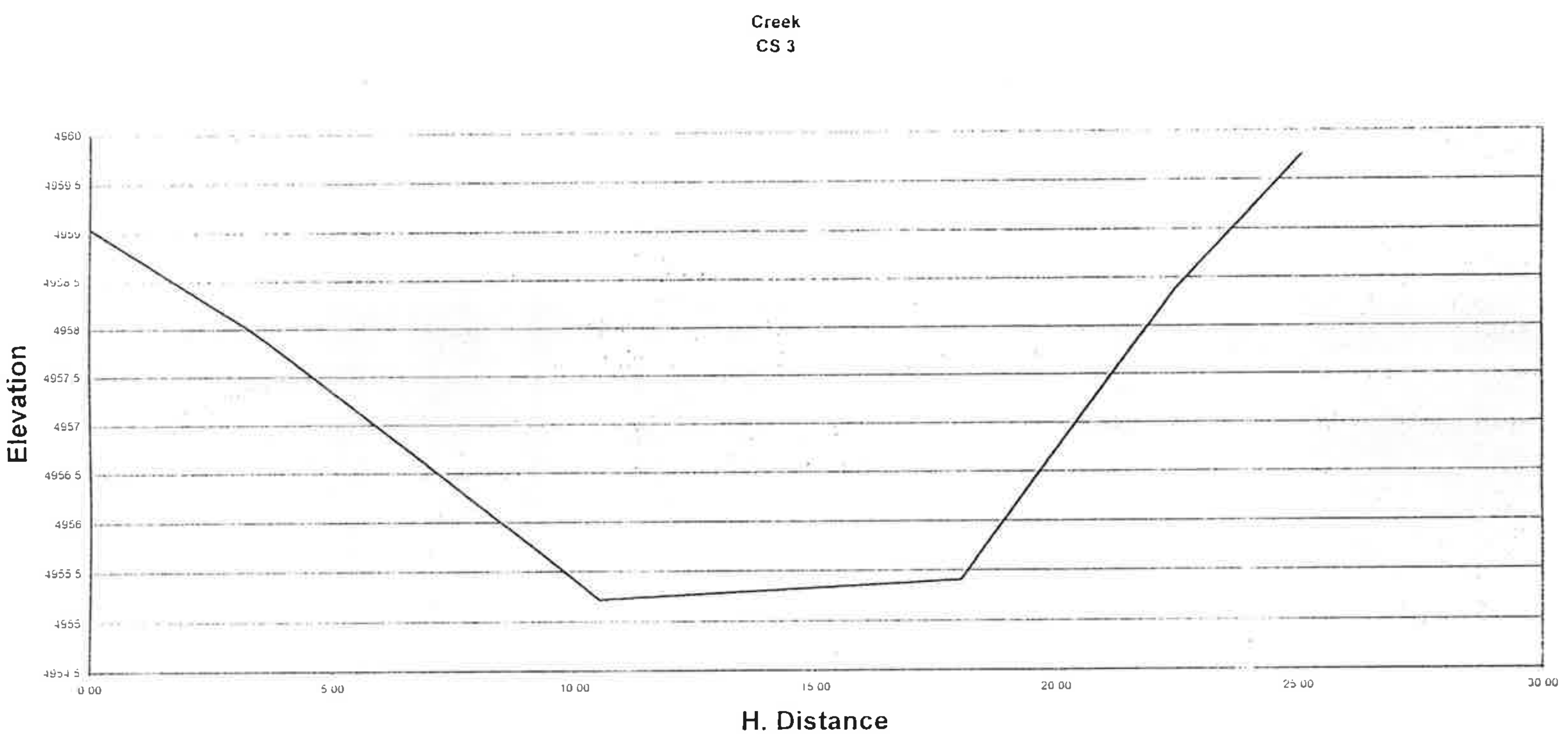
Critical Depth | Normal Depth | Rating Curve | Water Surface Profile

0.01 to 1000000

start HYDROCALC HYDRA... 3:42 PM

CS 3

Point Number	Northing	Easting	Elevation	Type	Point to Point Distance	Cumulative Distance	Elevation
12417	14910488	2262787	4959.377	CS 3	50.00	0.00	4959.377
12418	14910483	2262791	4956.17	CS 3	6.82	6.82	4956.17
12419	14910474	2262798	4955.73	CS 3	11.39	18.21	4955.73
12420	14910469	2262802	4958.686	CS 3	6.64	24.85	4958.686



Draft Report on HEC_RAS Model of the Drainage Channel south of the Reno/Stead Wastewater Treatment Facility as of May 4, 2005

Steps Taken:

1. Obtain Cross Sectional Data

Cross sectional data were obtained on two occasions, March 24, and April 5, 2005. These were obtained using GPS surveying equipment. The initial four cross sections were taken with four points each, one on the top of each bank and two more at the low-flow channel width. None were taken mid-channel. These cross sections represent the existing rip-rap channel. These cross sections were numbered 20.1 through 23.4 with 23.4 being the most downstream point at the end of the rip-rap. Further cross sections were taken on April 5, 2005, from the end of the rip-rap channel to the point where the treated effluent is released into the channel. These 17 cross sections were designated from River Station 19.01 (upstream) to 1.19 (downstream). These cross sections are more representative of channel geometry and contain more points per cross section. Table 1 shows the River Station numbers with their associated distance to the next cross section.

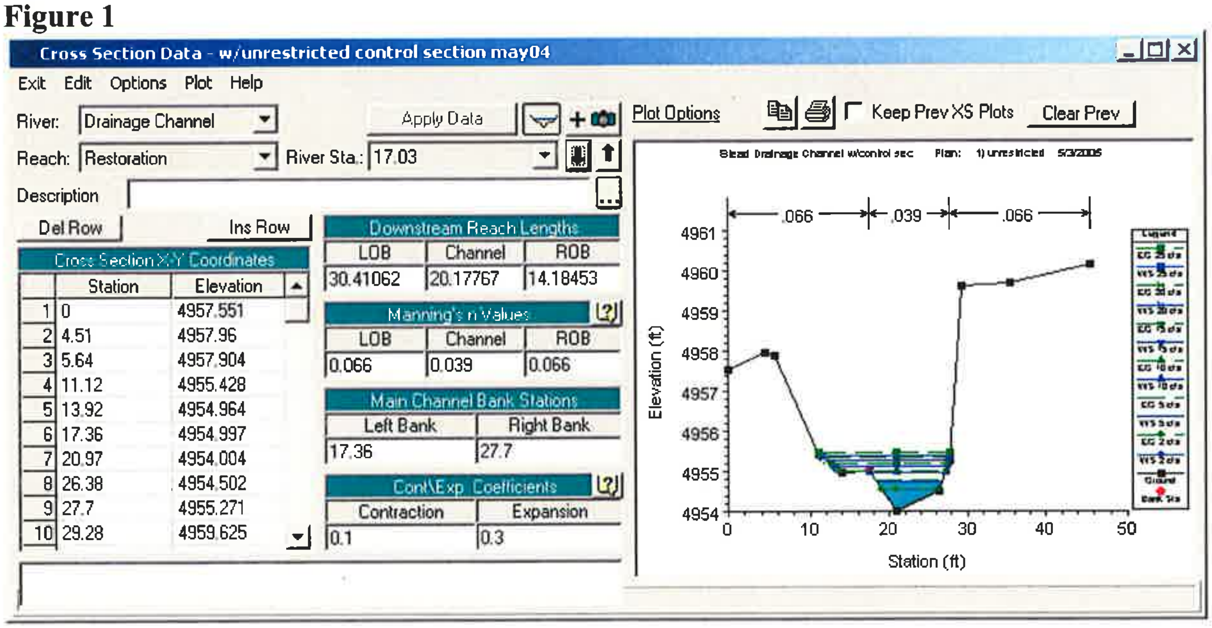
Table 1

Distance to downstream cross section	River Station	
51.60	25	Upstream
10.00	24.4	
10.00	24.3	
10.00	24.2	
33.00	24.1	
11.38	23.4	
11.10	22.3	
14.15	21.2	
4.00	20.1	
21.39	19.01	
20.18	17.03	
42.89	16.04	
48.54	15.05	
47.39	14.06	
49.60	13.07	
49.98	12.08	
50.43	11.09	
98.05	10.1	
67.78	9.11	
43.99	8.12	
49.18	7.13	
33.30	6.14	
62.53	5.15	
116.40	4.16	
20.40	3.17	
0	1.19	Downstream

2. Input into HEC-RAS

Data obtained from surveying cross sections was input into AutoCAD. Renzo Calegari then transformed this data into an Excel spreadsheet which could be utilized to input data into the HEC-RAS program. The data consisted of northing, easting, station, and elevation for each cross section. The cross sections were input into HEC-RAS by adding new cross sections in the *Cross Section Data* window in HEC-RAS in the *Edit Geometric Data* window. Elevation data with their associated stations, which represents their distance from the left bank, were then entered into the *Cross Section X-Y Coordinates* in the *Cross Section Data* window. The *Manning's n values* were set to default HEC-RAS values with the rip-rap channel's values being set at .033 all the way across the cross section, and for the natural degrading channel, a value of .066 for the left and right over-bank, and .039 for the channel bottom. *Main Channel Bank Stations* were determined by using the water line determined during data collection. To determine *Downstream Reach Lengths* in the *Cross Sectional Data* window, the Pythagorean Theorem was utilized by taking the known *XS Schematic Lines* coordinates for each cross section for each the leftmost, center, and rightmost points. The answers obtained via Excel spreadsheet gave us our distance. *Cont/Exp Coefficients* were set to default HEC-RAS values. An example of a completed cross section is shown in Figure 1.

Figure 1



For correct placement of each cross section, northing and easting coordinate values obtained from GPS survey equipment were then entered as *XS Schematic Lines* in the *Geometric Data* editor under the *Edit* menu for each cross section, as shown in Figure 2. The *XS Schematic Lines* data is then displayed in the *Geometric Data* window, representing our cross sections as shown in Figure 3.

Figure 2. ***XS Schematic Lines*** **entry screen**

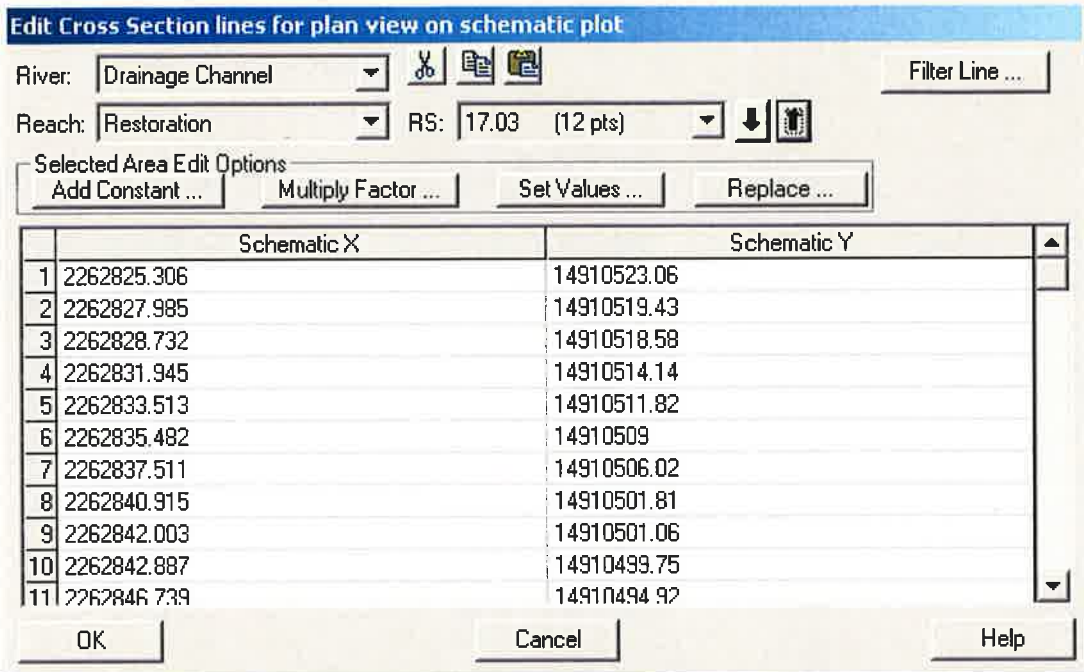
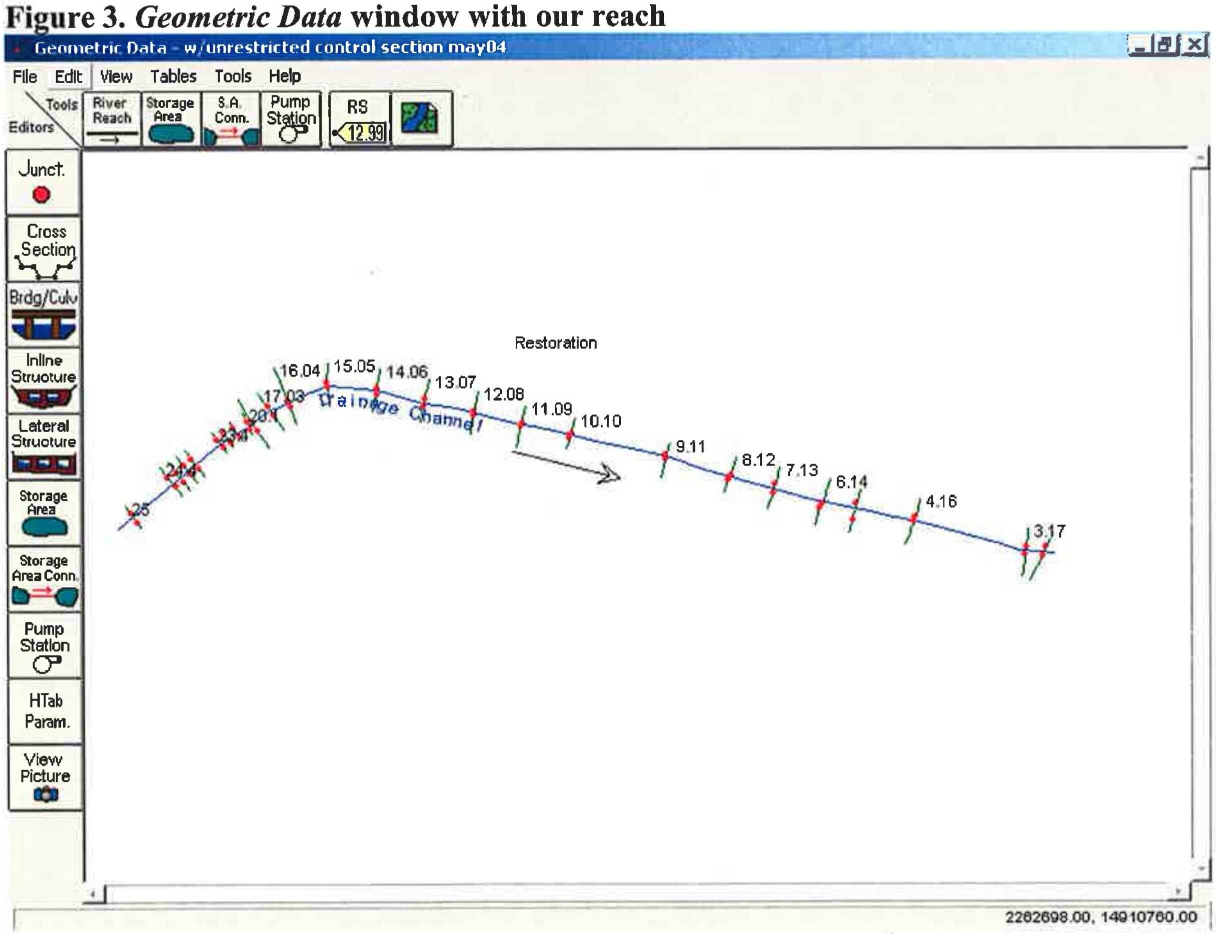


Figure 3. ***Geometric Data*** **window with our reach**



A further cross section was added approximately 100 feet upstream from cross section number 23.4. This was added as a precursor to adding our control section to measure flow. This cross section was determined using the same cross sectional data as in 23.4 and elevations were adjusted using our average slope for our previously entered cross sections. Bank stations, Manning's n values, and Cont/Exp coefficients were set the same as for 23.4.

Our control section was then added, upon advisement by Glen Daily, as a 30 foot concrete lined cross sectional area uniform in dimensions to somewhat match the existing channel, determined to be 24 feet across. The four segments representing each of these cross sections were named 24.1, 24.2, 24.3, and 24.4. These four cross sections were spaced 10 feet apart. The elevations and station data were determined by copying the elevation and station data obtained for cross section 23.4. This was done in the *Cross Sections* window under the *Options* menu utilizing the *Copy Current Cross Section* option. This was done for each new cross section. The elevation data for the new cross sections were then further determined by multiplying the elevation data copied from 23.4 by a slope of .005, which was our average slope obtained from our measured cross sections. This value was subsequently added to each new cross section, created new elevation data for each new cross section. The *Station* data under the *Cross Section X-Y Coordinates* used for each cross section was set to 24 feet across from leftmost to rightmost point with cross sections 24.1 and 24.4 having 4 stations spaced equally between the points Cross sections 24.2 and 24.3 bank stations were adjusted using a middle stationing distance of 3 and middle to side point distance of 10.5. Downstream reach lengths for 24.2, 24.3, and 24.4 were set to 10 feet apart. The downstream reach length for 24.1 was obtained via the Excel spreadsheet formatted for previous cross sectional data utilizing the Pythagorean Theorem. Our upstream cross section, 25, was then adjusted using the Pythagorean Theorem.

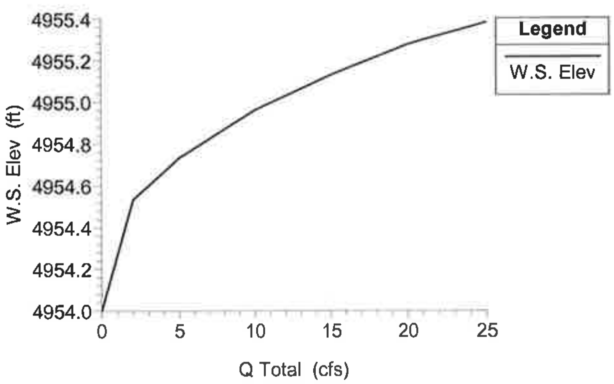
3. Running the Model

In the *Steady Flow Data* window, scenarios for 6 different flow regimes were represented: 2 cfs, 5 cfs, 10 cfs, 15 cfs, 20 cfs, and 25 cfs. These are named as such. For Reach Boundary Conditions, Normal Depth was input using our slope = 0.5%, being the average slope of our channel. The scenario was then run and computed. Our rating curves were then available and are attached with plan titled "Apr25 w/concrete."

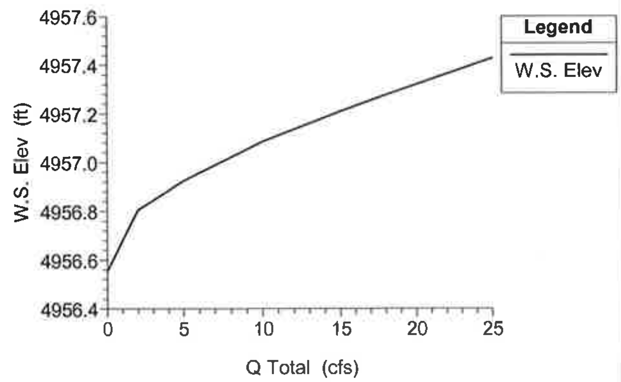
4. Analyzing Results

Rating curves were analyzed. Glen Daily then determined that our control section needn't be restricted in the center two sections. These cross sections were then adjusted to match those of 24.1 and 24.4. The resultant rating curves and X-Y-Z plot perspective are attached, with plan title "May04."

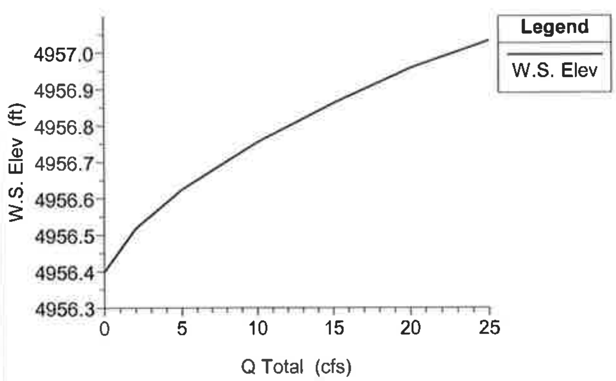
Stead Drainage Channel w/control sec Plan: may04 5/4/2005



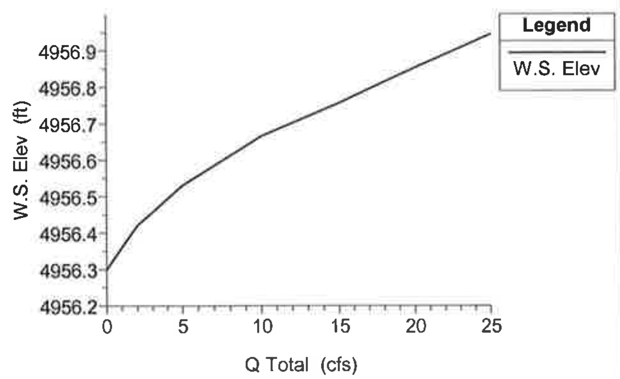
Stead Drainage Channel w/control sec Plan: may04 5/4/2005



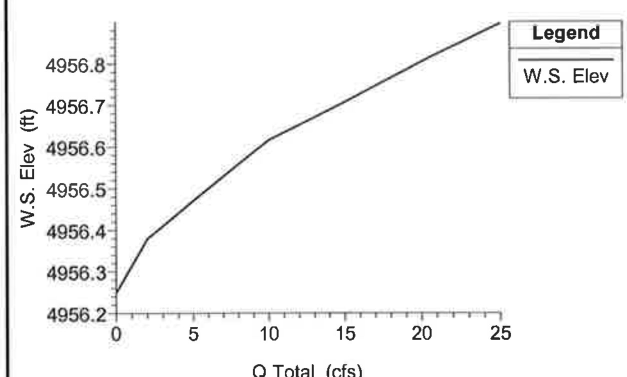
Stead Drainage Channel w/control sec Plan: may04 5/4/2005



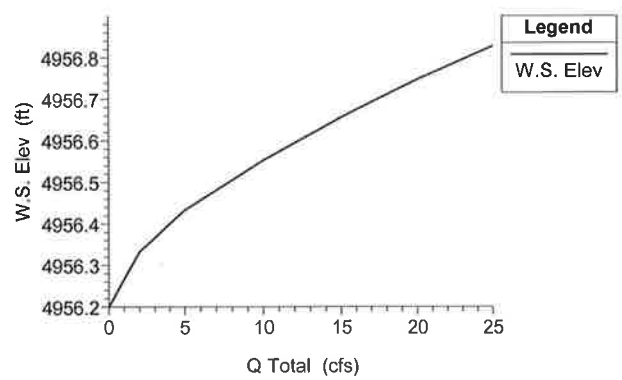
Stead Drainage Channel w/control sec Plan: may04 5/4/2005



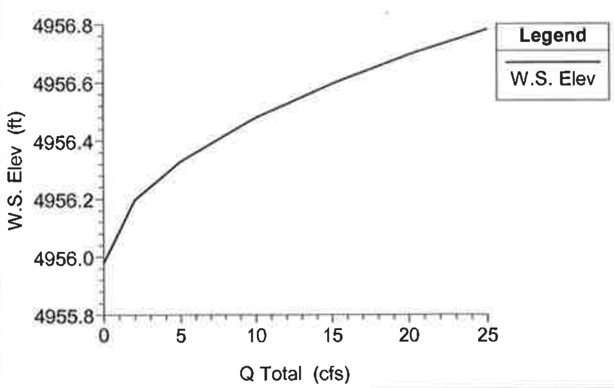
Stead Drainage Channel w/control sec Plan: may04 5/4/2005



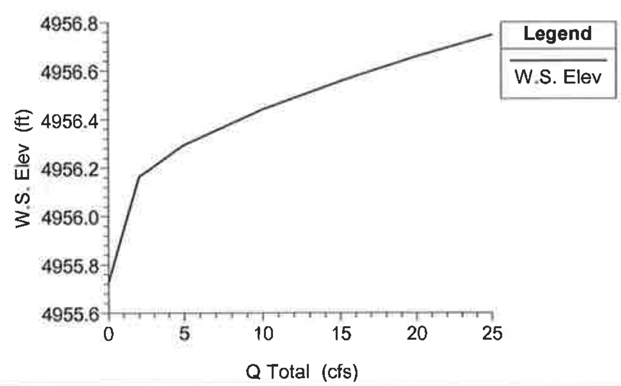
Stead Drainage Channel w/control sec Plan: may04 5/4/2005

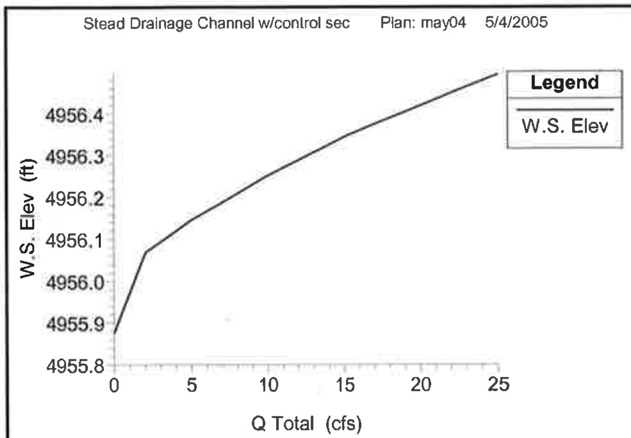


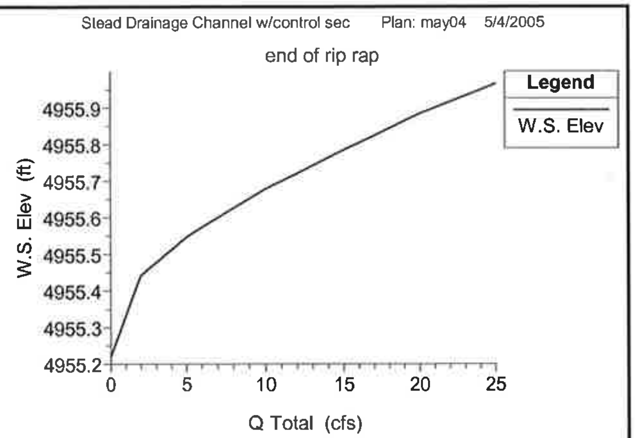
Stead Drainage Channel w/control sec Plan: may04 5/4/2005

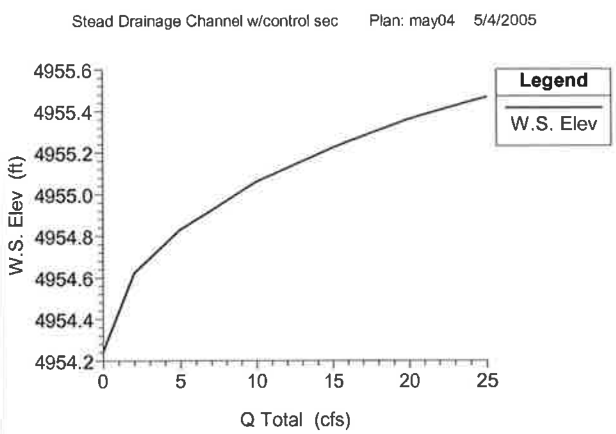


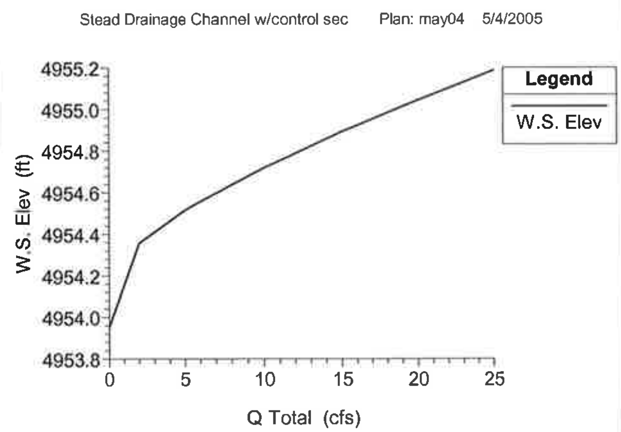
Stead Drainage Channel w/control sec Plan: may04 5/4/2005

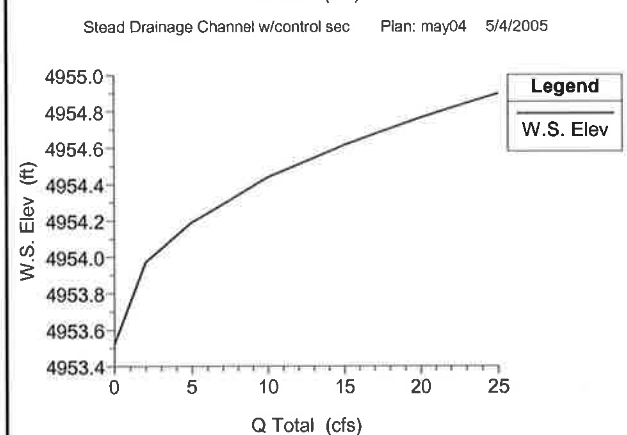


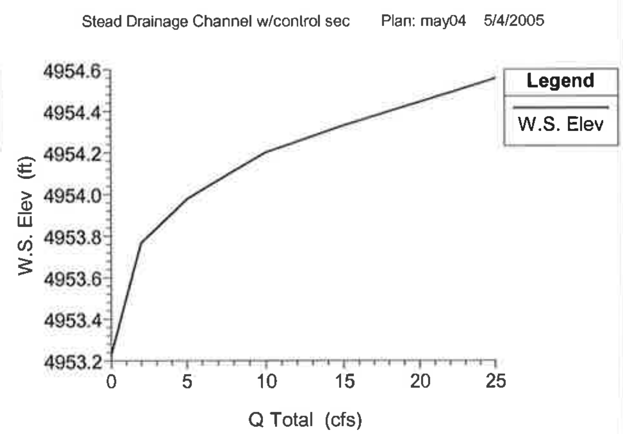

Stead Drainage Channel w/control sec Plan: may04 5/4/2005
Legend
W.S. Elev
W.S. Elev (ft)
4956.4
4956.3
4956.2
4956.1
4956.0
4955.9
4955.8
0 5 10 15 20 25
Q Total (cfs)

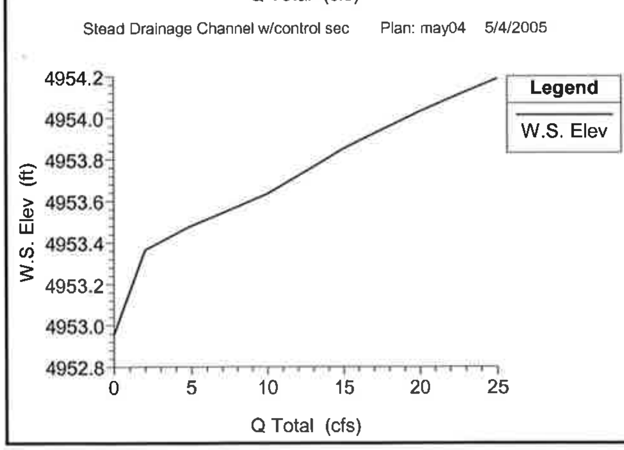

Stead Drainage Channel w/control sec Plan: may04 5/4/2005
end of rip rap
Legend
W.S. Elev
W.S. Elev (ft)
4955.9
4955.8
4955.7
4955.6
4955.5
4955.4
4955.3
4955.2
0 5 10 15 20 25
Q Total (cfs)

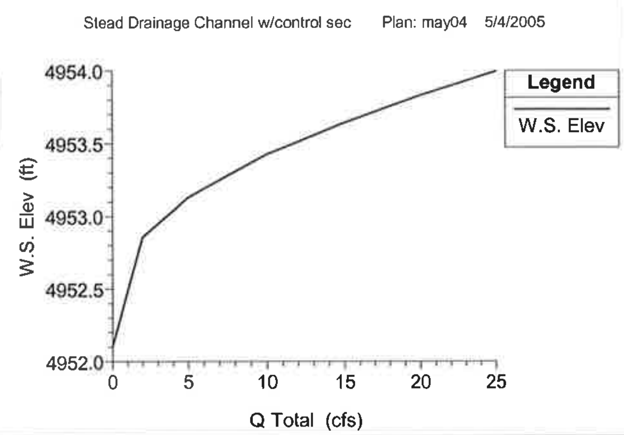

Stead Drainage Channel w/control sec Plan: may04 5/4/2005
Legend
W.S. Elev
W.S. Elev (ft)
4955.6
4955.4
4955.2
4955.0
4954.8
4954.6
4954.4
4954.2
0 5 10 15 20 25
Q Total (cfs)

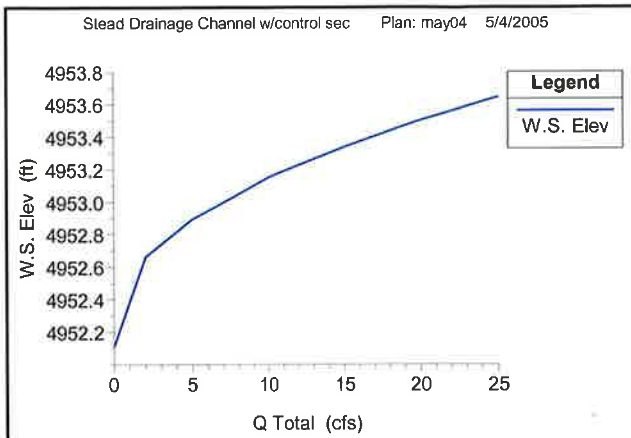

Stead Drainage Channel w/control sec Plan: may04 5/4/2005
Legend
W.S. Elev
W.S. Elev (ft)
4955.2
4955.0
4954.8
4954.6
4954.4
4954.2
4954.0
4953.8
0 5 10 15 20 25
Q Total (cfs)

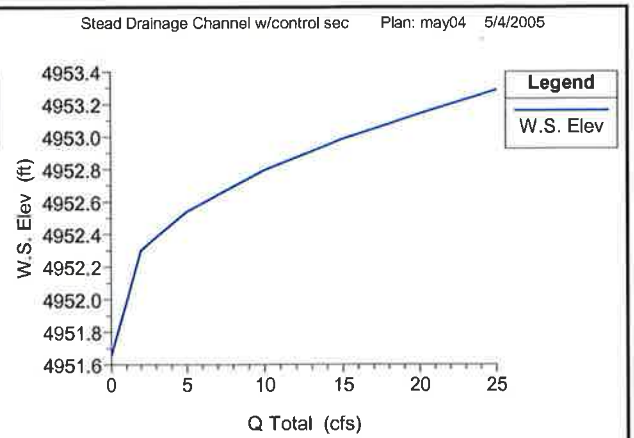

Stead Drainage Channel w/control sec Plan: may04 5/4/2005
Legend
W.S. Elev
W.S. Elev (ft)
4955.0
4954.8
4954.6
4954.4
4954.2
4954.0
4953.8
4953.6
4953.4
0 5 10 15 20 25
Q Total (cfs)

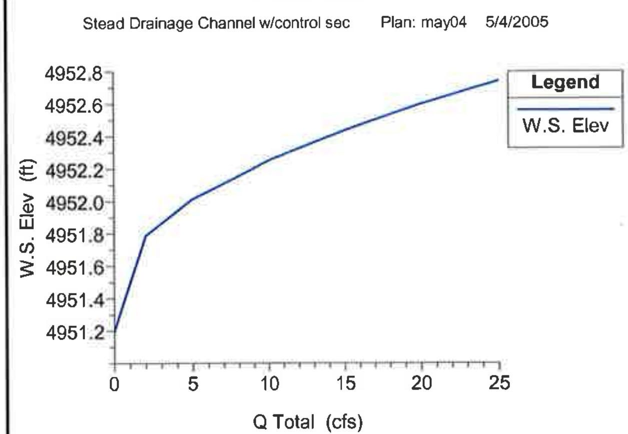

Stead Drainage Channel w/control sec Plan: may04 5/4/2005
Legend
W.S. Elev
W.S. Elev (ft)
4954.6
4954.4
4954.2
4954.0
4953.8
4953.6
4953.4
4953.2
0 5 10 15 20 25
Q Total (cfs)

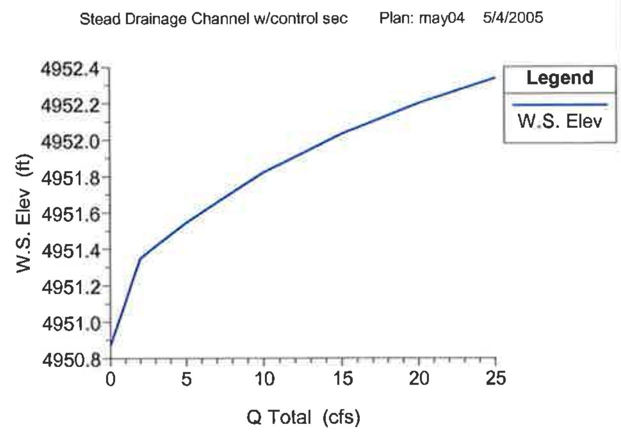

Stead Drainage Channel w/control sec Plan: may04 5/4/2005
Legend
W.S. Elev
W.S. Elev (ft)
4954.2
4954.0
4953.8
4953.6
4953.4
4953.2
4953.0
4952.8
0 5 10 15 20 25
Q Total (cfs)

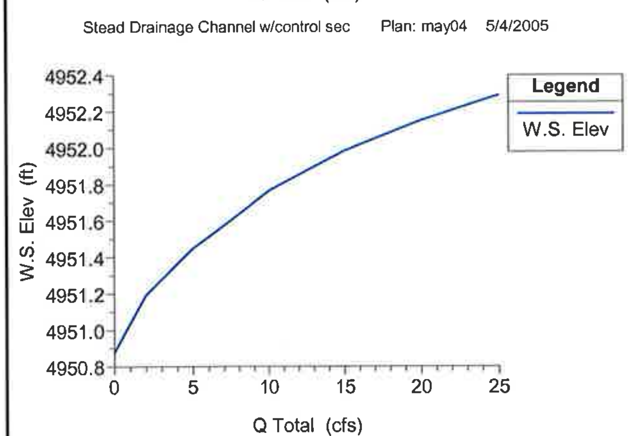

Stead Drainage Channel w/control sec Plan: may04 5/4/2005
Legend
W.S. Elev
W.S. Elev (ft)
4954.0
4953.5
4953.0
4952.5
4952.0
0 5 10 15 20 25
Q Total (cfs)

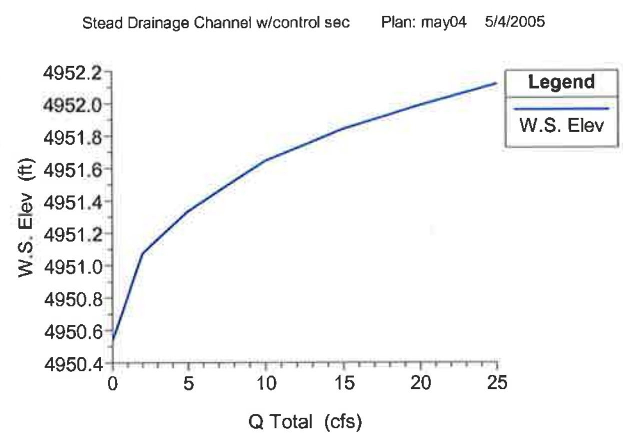

Stead Drainage Channel w/control sec Plan: may04 5/4/2005
Legend
W.S. Elev
W.S. Elev (ft)
4953.8
4953.6
4953.4
4953.2
4953.0
4952.8
4952.6
4952.4
4952.2
0
5
10
15
20
25
Q Total (cfs)

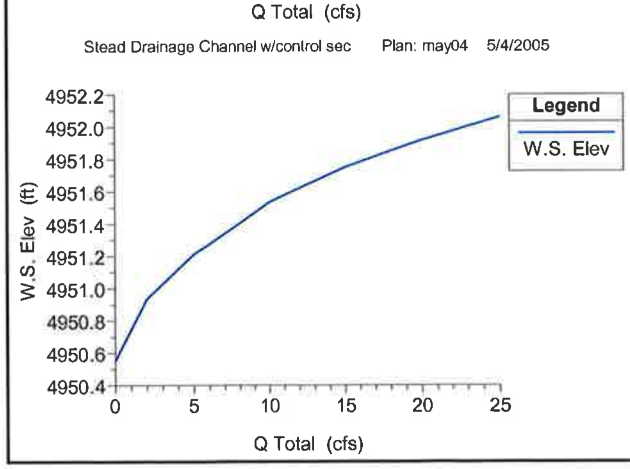

Stead Drainage Channel w/control sec Plan: may04 5/4/2005
Legend
W.S. Elev
W.S. Elev (ft)
4953.4
4953.2
4953.0
4952.8
4952.6
4952.4
4952.2
4952.0
4951.8
4951.6
0
5
10
15
20
25
Q Total (cfs)

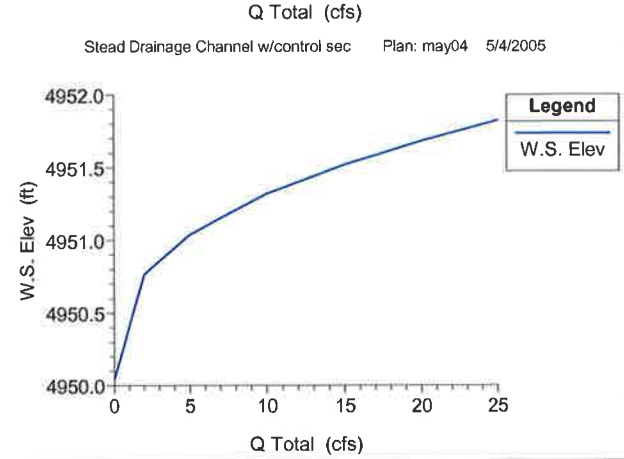

Stead Drainage Channel w/control sec Plan: may04 5/4/2005
Legend
W.S. Elev
W.S. Elev (ft)
4952.8
4952.6
4952.4
4952.2
4952.0
4951.8
4951.6
4951.4
4951.2
0
5
10
15
20
25
Q Total (cfs)

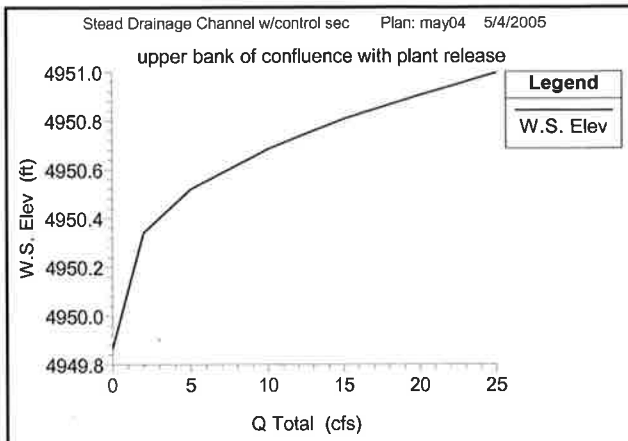

Stead Drainage Channel w/control sec Plan: may04 5/4/2005
Legend
W.S. Elev
W.S. Elev (ft)
4952.4
4952.2
4952.0
4951.8
4951.6
4951.4
4951.2
4951.0
4950.8
0
5
10
15
20
25
Q Total (cfs)


Stead Drainage Channel w/control sec Plan: may04 5/4/2005
Legend
W.S. Elev
W.S. Elev (ft)
4952.4
4952.2
4952.0
4951.8
4951.6
4951.4
4951.2
4951.0
4950.8
0
5
10
15
20
25
Q Total (cfs)

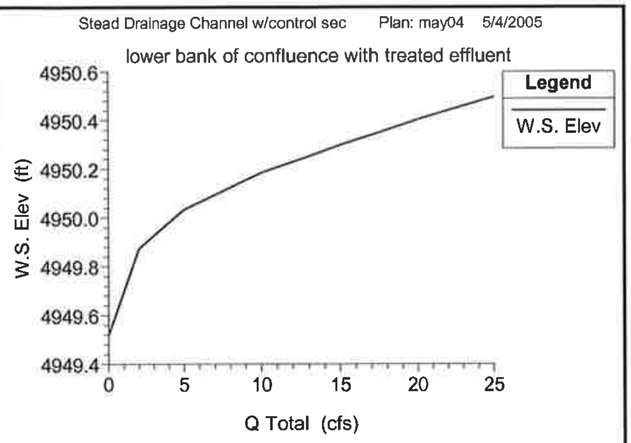

Stead Drainage Channel w/control sec Plan: may04 5/4/2005
Legend
W.S. Elev
W.S. Elev (ft)
4952.2
4952.0
4951.8
4951.6
4951.4
4951.2
4951.0
4950.8
4950.6
4950.4
0
5
10
15
20
25
Q Total (cfs)


Stead Drainage Channel w/control sec Plan: may04 5/4/2005
Legend
W.S. Elev
W.S. Elev (ft)
4952.2
4952.0
4951.8
4951.6
4951.4
4951.2
4951.0
4950.8
4950.6
4950.4
0
5
10
15
20
25
Q Total (cfs)


Stead Drainage Channel w/control sec Plan: may04 5/4/2005
Legend
W.S. Elev
W.S. Elev (ft)
4952.0
4951.5
4951.0
4950.5
4950.0
0
5
10
15
20
25
Q Total (cfs)



Stead Drainage Channel w/control sec Plan: may04 5/4/2005
upper bank of confluence with plant release
Legend
W.S. Elev
W.S. Elev (ft)
4951.0
4950.8
4950.6
4950.4
4950.2
4950.0
4949.8
0
5
10
15
20
25
Q Total (cfs)



Stead Drainage Channel w/control sec Plan: may04 5/4/2005
lower bank of confluence with treated effluent
Legend
W.S. Elev
W.S. Elev (ft)
4950.6
4950.4
4950.2
4950.0
4949.8
4949.6
4949.4
0
5
10
15
20
25
Q Total (cfs)

NuWay Flume Products

Toll Free: (800)948-6236

Adjust-A-Flumes *(Adjustable Ramp Flumes)*

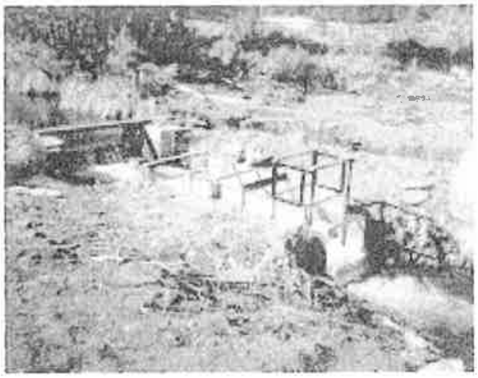
AF0.45	Flume, 0.45 cfs capacity	23 lbs.	$230.00
AF2.0	Flume, 2.0 cfs capacity	82 lbs.	400.00
AF4.0	Flume, 4.0 cfs capacity	103 lbs.	540.00
AF6.0	Flume, 6.0 cfs capacity	123 lbs.	625.00
AF11.0	Flume, 11.0 cfs capacity	412 lbs.	1,175.00
AF15.0	Flume, 15.0 cfs capacity	511 lbs.	1,580.00
AF25.0	Flume, 25.0 cfs capacity	698 lbs.	2,090.00
AF35.0	Flume, 35.0 cfs capacity	793 lbs.	2,600.00

EZ Flow Ramp Flumes

NAF3.5	Flume, 3.5 cfs capacity	62 lbs.	$297.00
NAF7.0	Flume, 7.0 cfs capacity	86 lbs.	354.00
NAF10.0	Flume, 10.0 cfs capacity	108 lbs.	394.00
NAF20.0	Flume, 20.0 cfs capacity	400 lbs.	1,266.00
NAF40.0	Flume, 40.0 cfs capacity	665 lbs.	1,992.00
NAF60.0	Flume, 60.0 cfs capacity	998 lbs.	2,806.00
NAF80.0	Flume, 80.0 cfs capacity	1208 lbs.	3,365.00
NAF100.0	Flume, 100.0 cfs capacity	1432 lbs.	3,925.00
NAF120.0	Flume, 120.0 cfs capacity	1684 lbs.	4,720.00

Stilling Well Assembly for Adjust-A-Flumes *(Other sizes available upon request)*

AF-SW2	2" Stilling Well Assembly for AF0.45, AF2.0, or AF4.0 Flumes	138.00

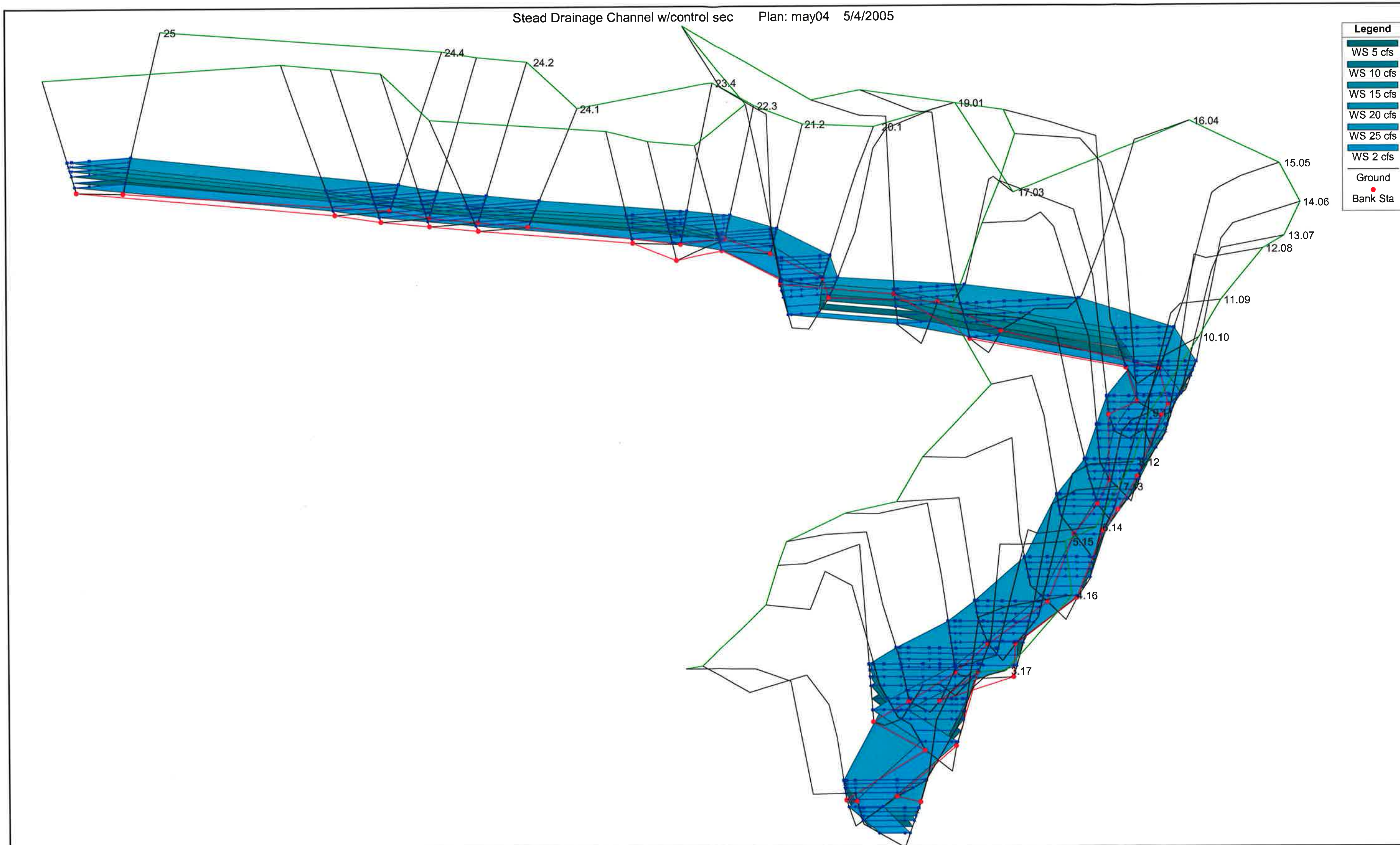


INTERMOUNTAIN ENVIRONMENTAL, INC.
INSTRUMENTATION FOR RESEARCH AND RESOURCE MANAGEMENT

601 W. 1700 S., Ste B
Logan, UT 84321-8247

Ph: 435-755-0774
Fx: 435-755-0794
Web: www.inmtn.com
E-mail: info@inmtn.com

Updated 9/02



Stead Drainage Channel w/control sec Plan: may04 5/4/2005
Legend
WS 5 cfs
WS 10 cfs
WS 15 cfs
WS 20 cfs
WS 25 cfs
WS 2 cfs
Ground
Bank Sta
25
24.4
24.2
24.1
23.4
22.3
21.2
20.1
19.01
17.03
16.04
15.05
14.06
13.07
12.08
11.09
10.10
4.16
3.17

INTERMOUNTAIN ENVIRONMENTAL, INC.
INSTRUMENTATION FOR RESEARCH AND RESOURCE MANAGEMENT
A CAMPBELL SCIENTIFIC PARTNER

Flumes - Galvanized Steel, and Stainless Steel

If you have any questions, please contact a technical sales representative for consultation on the right type of flume for your application. If you would like us to e-mail, or fax additional information and pricing including sizing and specifying a flume, please fill out and submit our "Flume Application Questionnaire Form".

Page 2 of 2

Intermountain Environmental offers many sizes of standard and adjustable ramp flumes for open channel flow monitoring. We also have a custom flume manufacturing shop that can build steel and stainless steel flumes to meet your flow measurement requirements.

2 cfs Adjust-a-Flume

▶ Product Literature (74 Kb PDF)

▶ Flow Tables (pdf)

▶ Independent Product Review

▶ Price List (44 Kb PDF) **

** Due to recent Steel Price changes the above price list may not be accurate. Please contact us for current pricing.

EZFlow (Standard Ramp Flume)

Adjust-A-Flume (Adjustable Ramp Flume)

- The simplest, most accurate, most cost effective solution to your water metering requirements!
- Constructed of high quality galvanized or stainless steel
- Consistently achieve accuracies to within +/- 3%
- Installation is quick and straight forward
- Direct-reading flow-rate gages on side walls (no need to carry a book of flow tables)
- Can be installed in canals and ditches without causing significant ponding.
- Wide flow rate range
- Tolerance to various canal depths
- Many sizes to choose from:

Adjust-a-Flume Sizes

Flume Size CFS	Minimum CFS	Flow GPM	Maximum CFS	Flow GPM	Weight-LBS
0.45	0.0125	5	0.45	200	26
2.0	0.10	45	2.0	898	82
4.0	0.25	112	4.0	1795	108
6.0	0.50	224	6.0	2693	133
11.0	0.50	224	11.0	4937	412
15.00	1.00	449	15.0	6732	511
25.00	1.5	673	25.0	11221	652
35.0	2.0	898	35.0	15709	793

EZFlow Sizes

Options and Accessories:

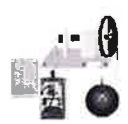
Attached Stilling Wells in 2", 6", or 8" dia.

Flume Size Maximum	Flow	Minimum	Flow	
CFS	GPM	CFS	GPM	Weight-LBS
3.5	1571	0.1	45	62
7.0	3142	0.1	45	86
10.0	4488	0.1	45	108
20.0	8976	0.5	224	400
40.0	17952	1.0	448	665
60.0	26928	1.5	672	732
80.0	35904	2.0	896	890
100.0	44880	2.5	1120	1020
120.0	53856	3.0	1344	1136
140.0	62832	3.5	1568	1258
160.0	71808	4.0	1792	1389
180.0	80784	4.5	2016	1538

Choosing the correct flume size for your application is important. It is suggested that the smallest size flume that will accommodate the correct flow be used.

Automate the Level/Flow monitoring process by adding one of these instruments to the Adjust-a-Flume

miniTroll - Pressure Transducer / Logger



AquaPod - Potentiometric Float & Pulley / Logger (requires a stilling well)

PULS1 - Ultrasonic Sensor / Logger

WierStick - Pressure Transducer / Logger

Ecotone - Capacitance Sensor / Logger

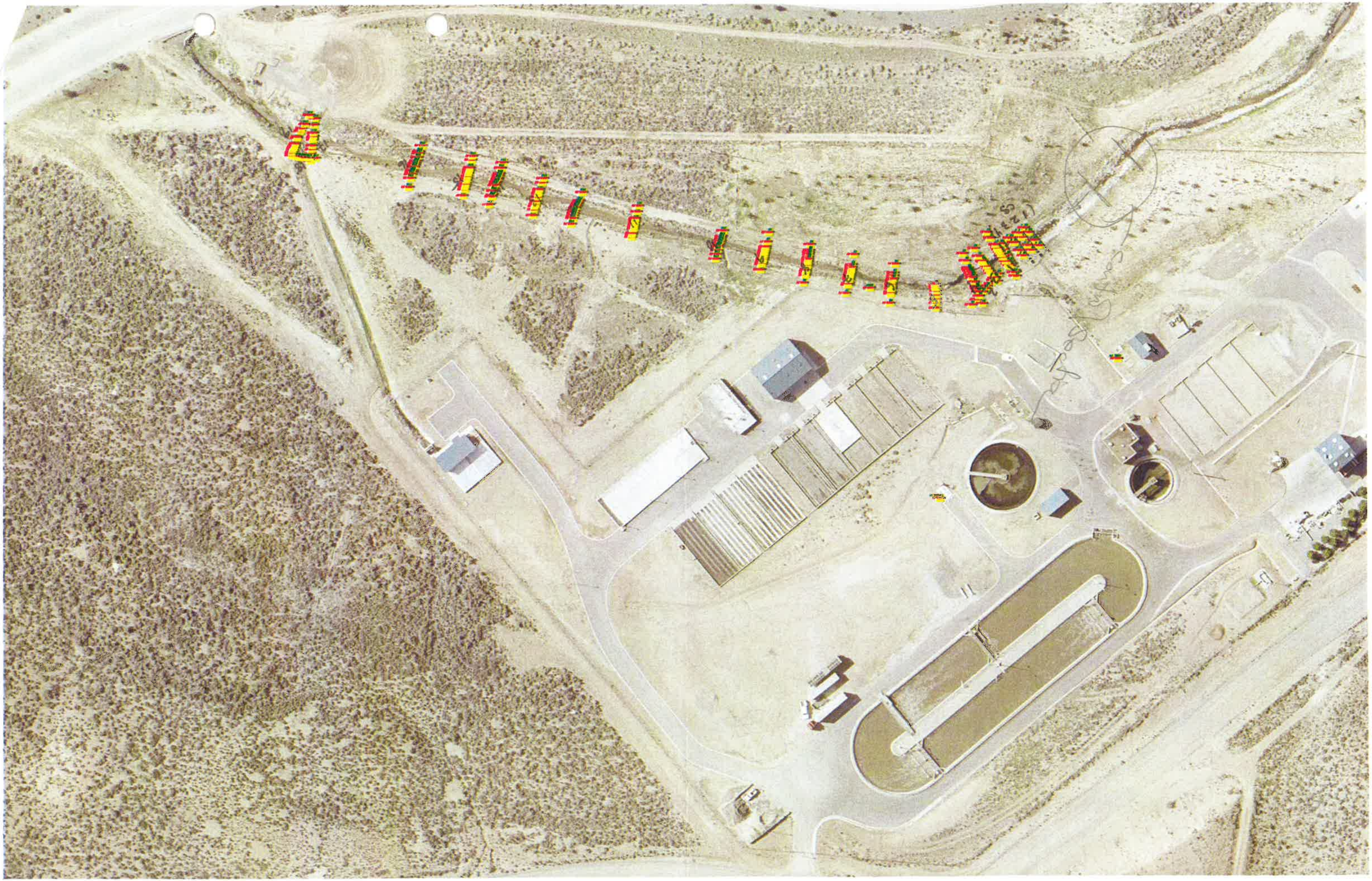
Custom Galvanized Steel and Stainless Steel Flumes

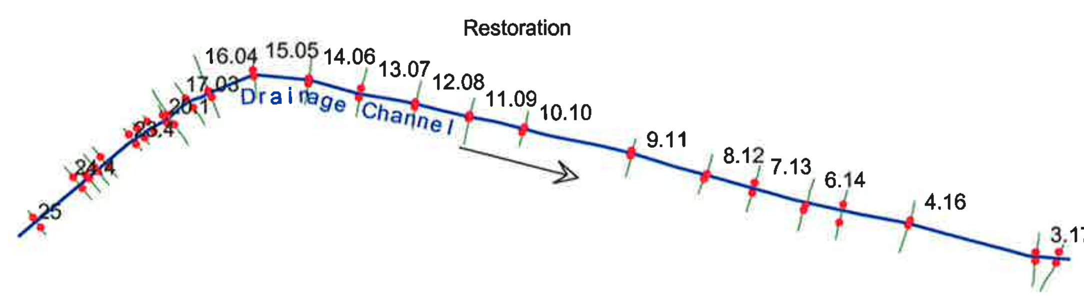
Our shop facility can manufacture galvanized steel and stainless steel flumes. The galvanized steel flumes are typically less expensive, but not as long lasting as the FRP flumes. Stainless steel flumes are much more expensive, but will outlast even the FRP flumes. These flumes are manufactured on an as ordered basis for Intermountain Environmental, so our delivery times for these flumes are about 6-8 weeks. Contact a sales representative to request a quotation and delivery time estimate.

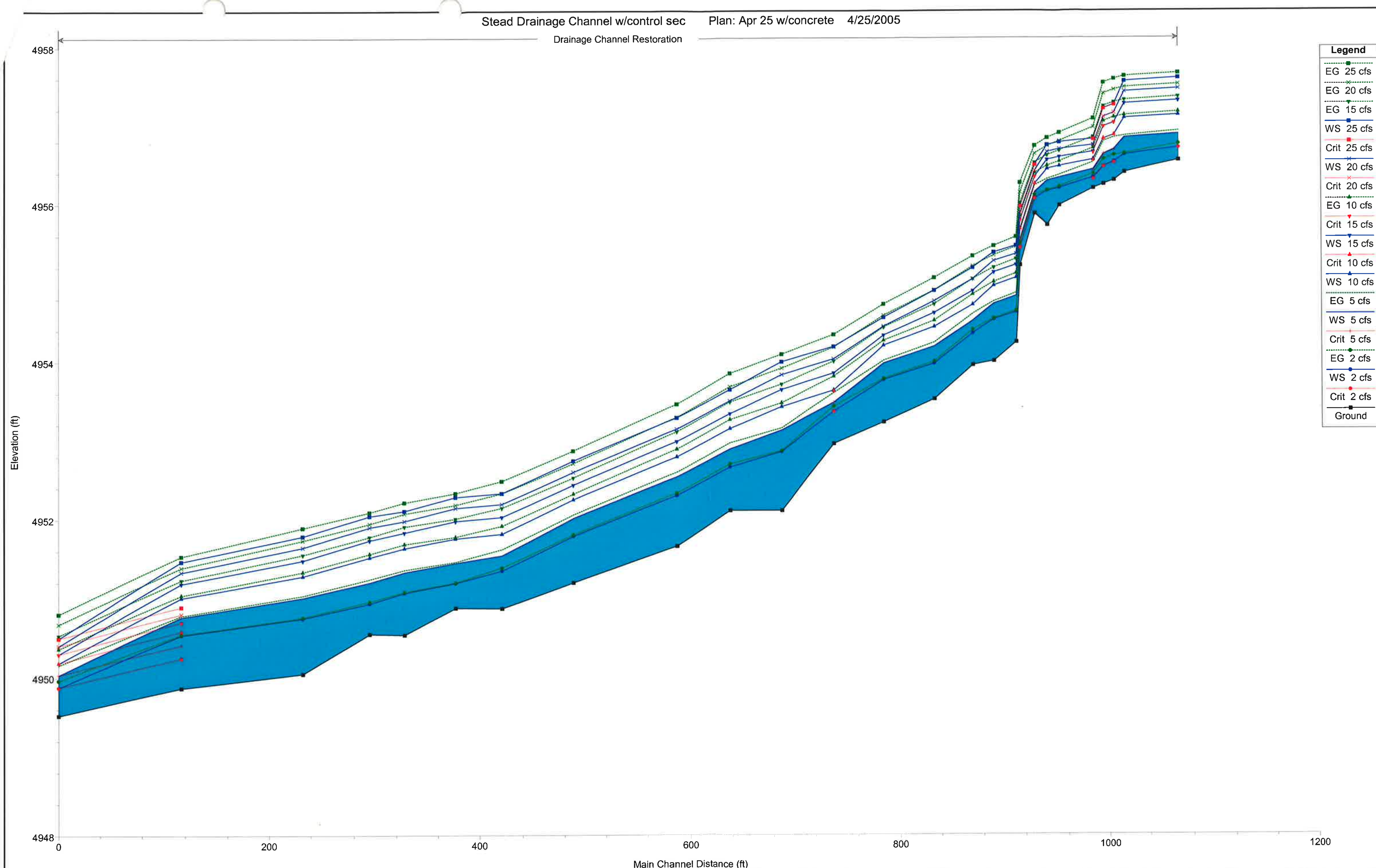
◀ ***Previous Page***

Home | User Applications | New Products | Sales & Support | Request Information | Privacy Policy

Please report any problems with this web site to our Web Master. Thank you.

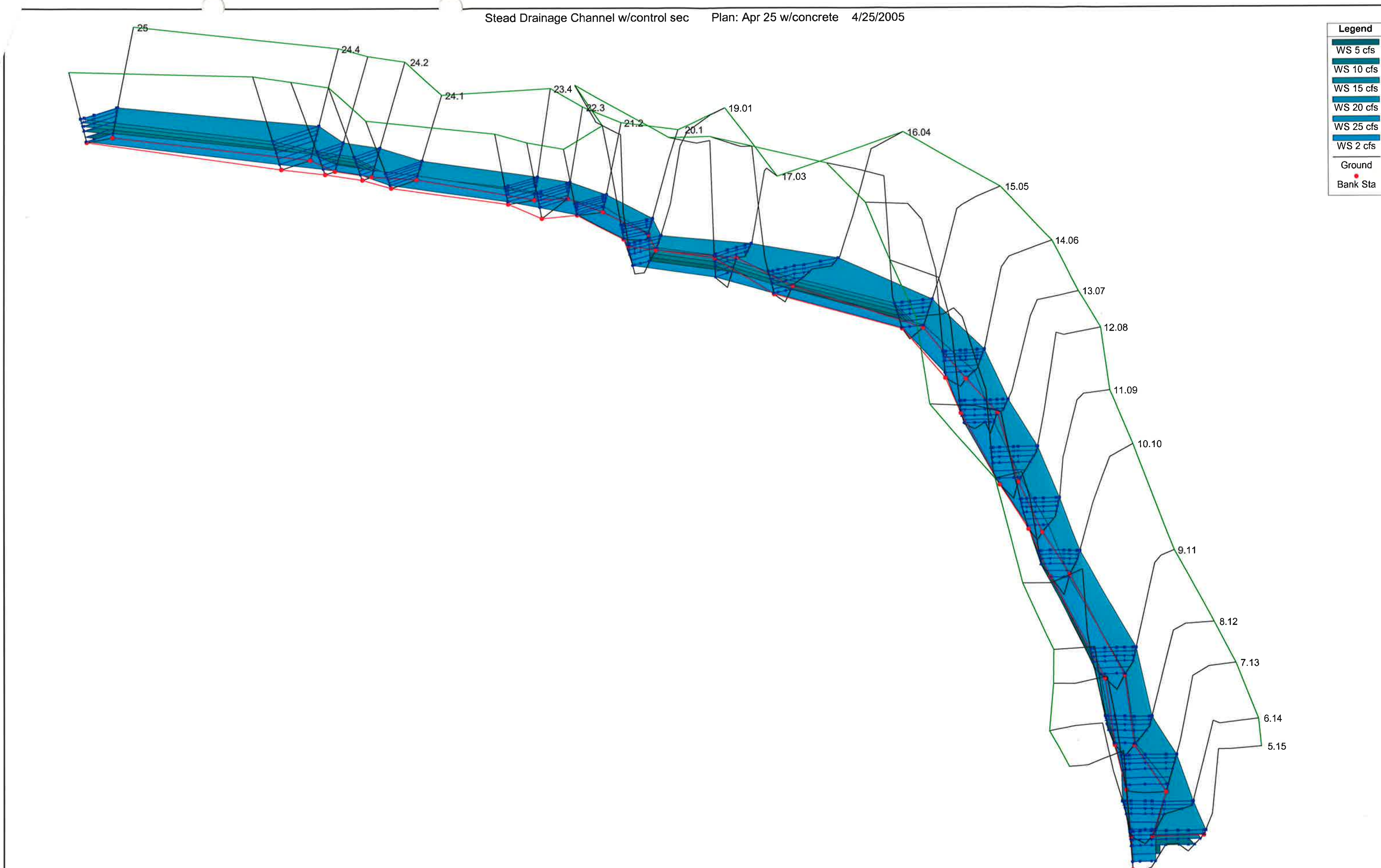


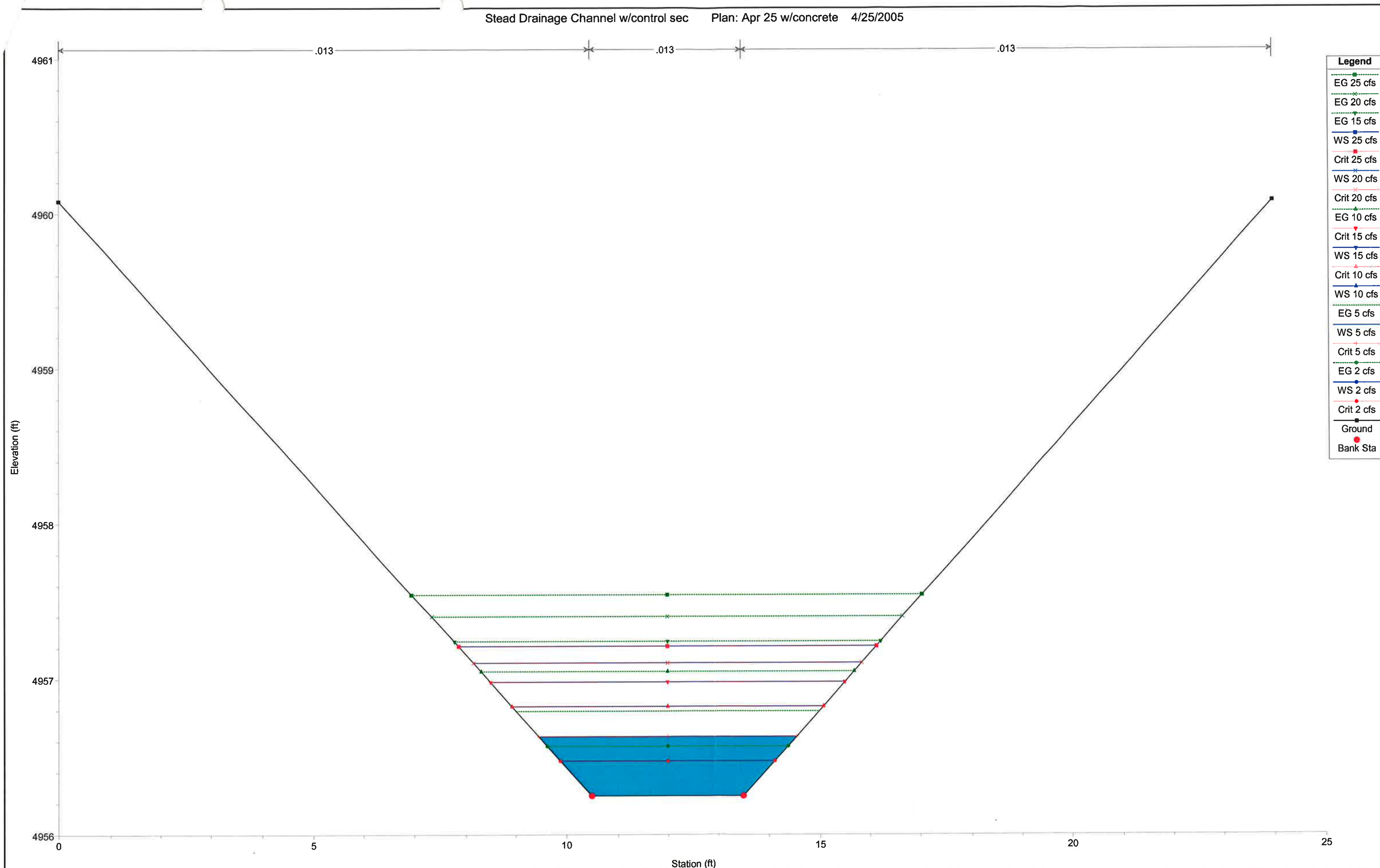

Restoration
16.04
15.05
14.06
13.07
12.08
11.09
10.10
17.03
20.1
Drainage Channel
9.11
8.12
7.13
6.14
4.16
3.17
25



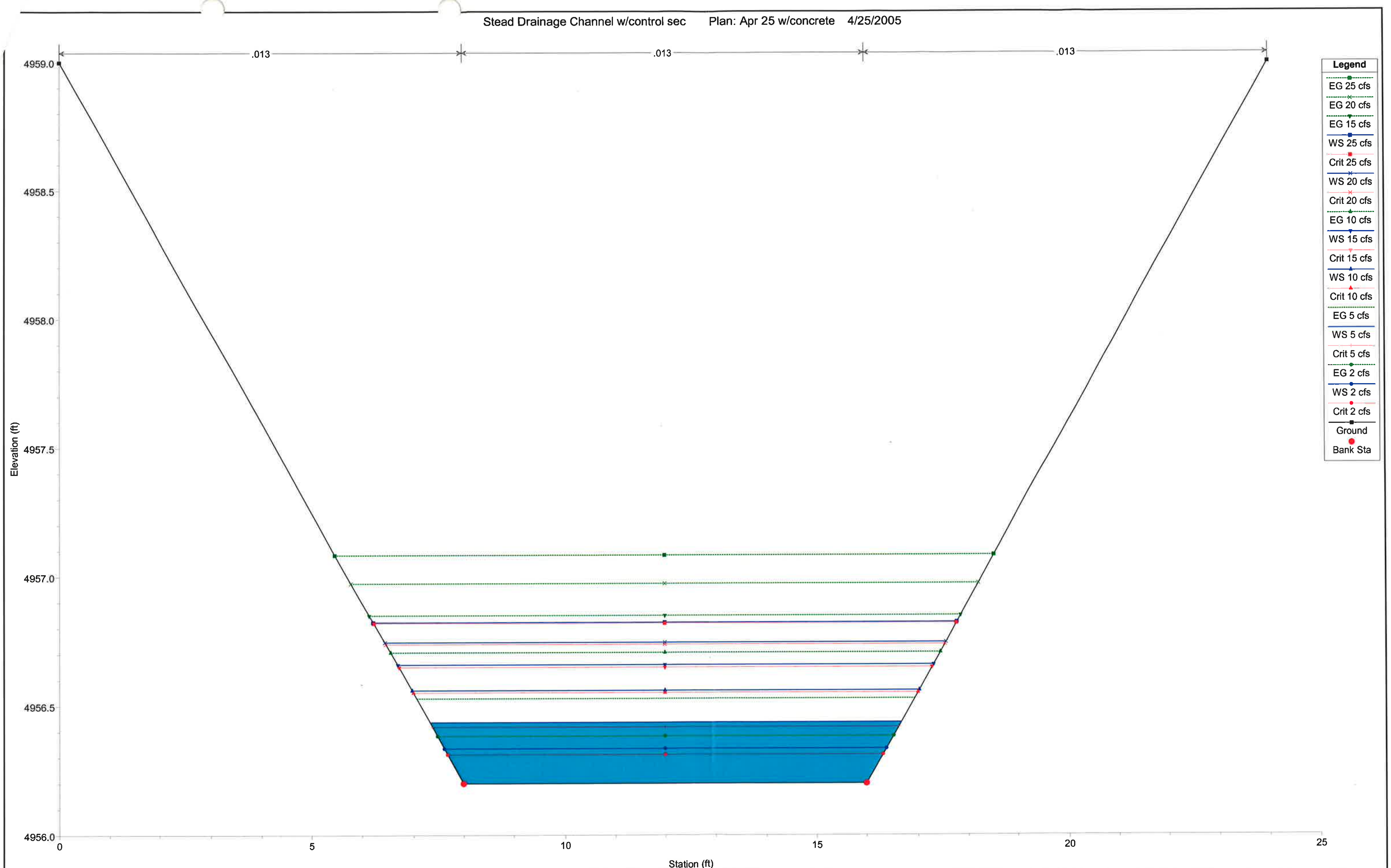
Stead Drainage Channel w/control sec
Plan: Apr 25 w/concrete
4/25/2005
Drainage Channel Restoration
Legend
EG 25 cfs
EG 20 cfs
EG 15 cfs
WS 25 cfs
Crit 25 cfs
WS 20 cfs
Crit 20 cfs
EG 10 cfs
Crit 15 cfs
WS 15 cfs
Crit 10 cfs
WS 10 cfs
EG 5 cfs
WS 5 cfs
Crit 5 cfs
EG 2 cfs
WS 2 cfs
Crit 2 cfs
Ground
Elevation (ft)
4958
4956
4954
4952
4950
4948
0
200
400
600
800
1000
1200
Main Channel Distance (ft)

Stead Drainage Channel w/control sec Plan: Apr 25 w/concrete 4/25/2005

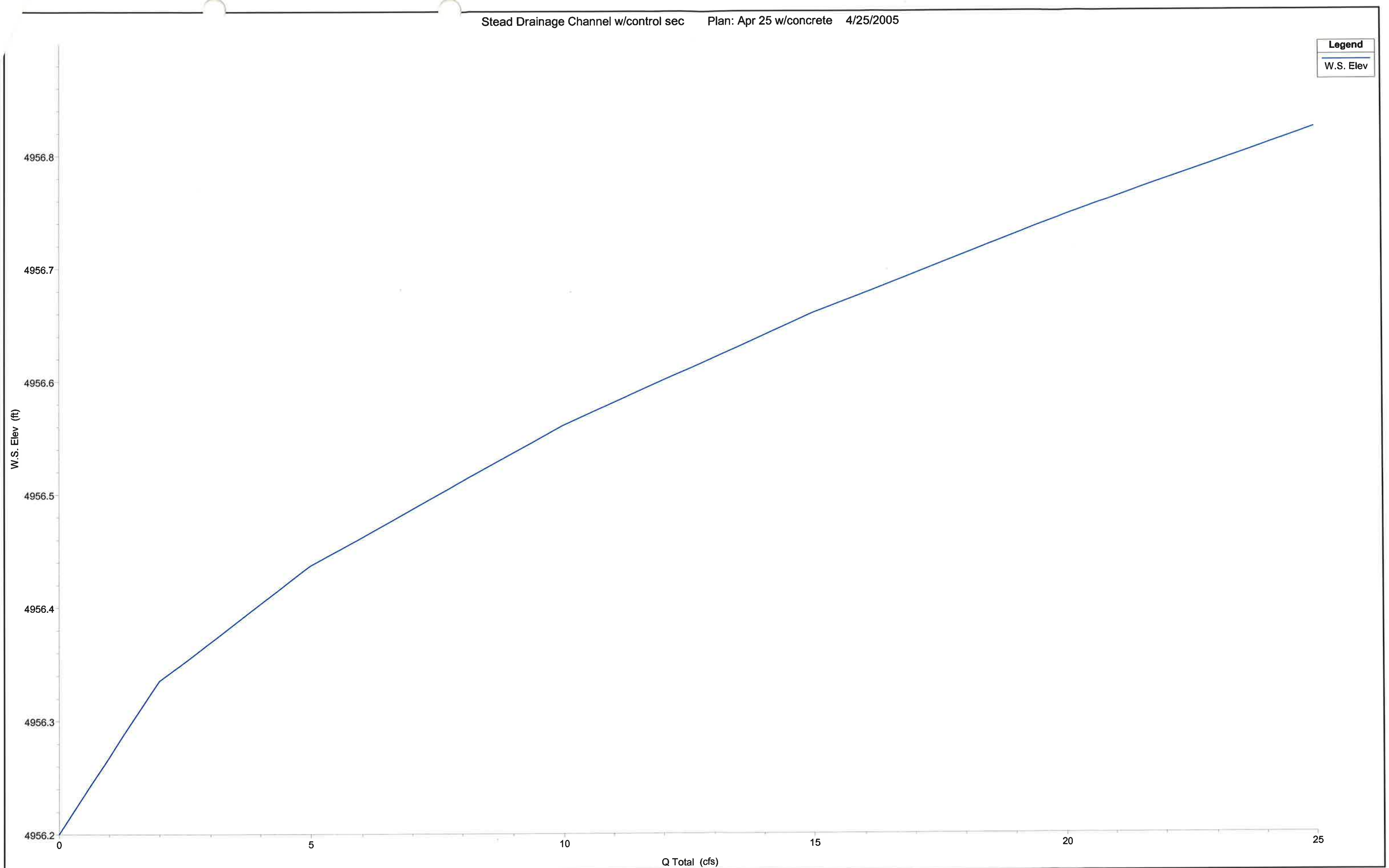



Stead Drainage Channel w/control sec
Plan: Apr 25 w/concrete
4/25/2005
.013
.013
.013
Legend
EG 25 cfs
EG 20 cfs
EG 15 cfs
WS 25 cfs
Crit 25 cfs
WS 20 cfs
Crit 20 cfs
EG 10 cfs
Crit 15 cfs
WS 15 cfs
Crit 10 cfs
WS 10 cfs
EG 5 cfs
WS 5 cfs
Crit 5 cfs
EG 2 cfs
WS 2 cfs
Crit 2 cfs
Ground
Bank Sta
Elevation (ft)
4961
4960
4959
4958
4957
4956
Station (ft)
0
5
10
15
20
25

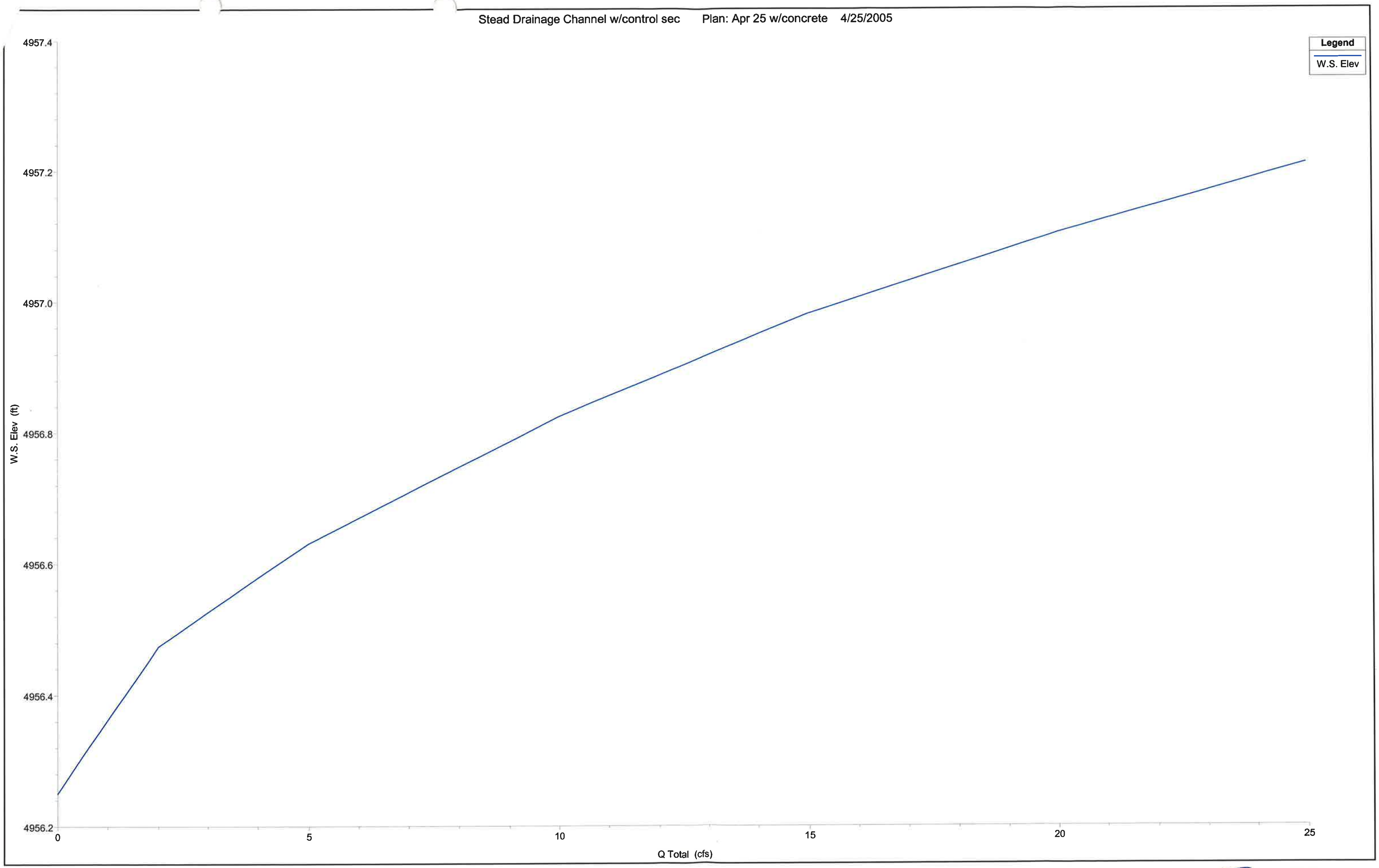
STA. 24.1


Stead Drainage Channel w/control sec Plan: Apr 25 w/concrete 4/25/2005
.013
.013
.013
Elevation (ft)
4959.0
4958.5
4958.0
4957.5
4957.0
4956.5
4956.0
Station (ft)
0
5
10
15
20
25
Legend
EG 25 cfs
EG 20 cfs
EG 15 cfs
WS 25 cfs
Crit 25 cfs
WS 20 cfs
Crit 20 cfs
EG 10 cfs
WS 15 cfs
Crit 15 cfs
WS 10 cfs
Crit 10 cfs
EG 5 cfs
WS 5 cfs
Crit 5 cfs
EG 2 cfs
WS 2 cfs
Crit 2 cfs
Ground
Bank Sta

STA. 24.2

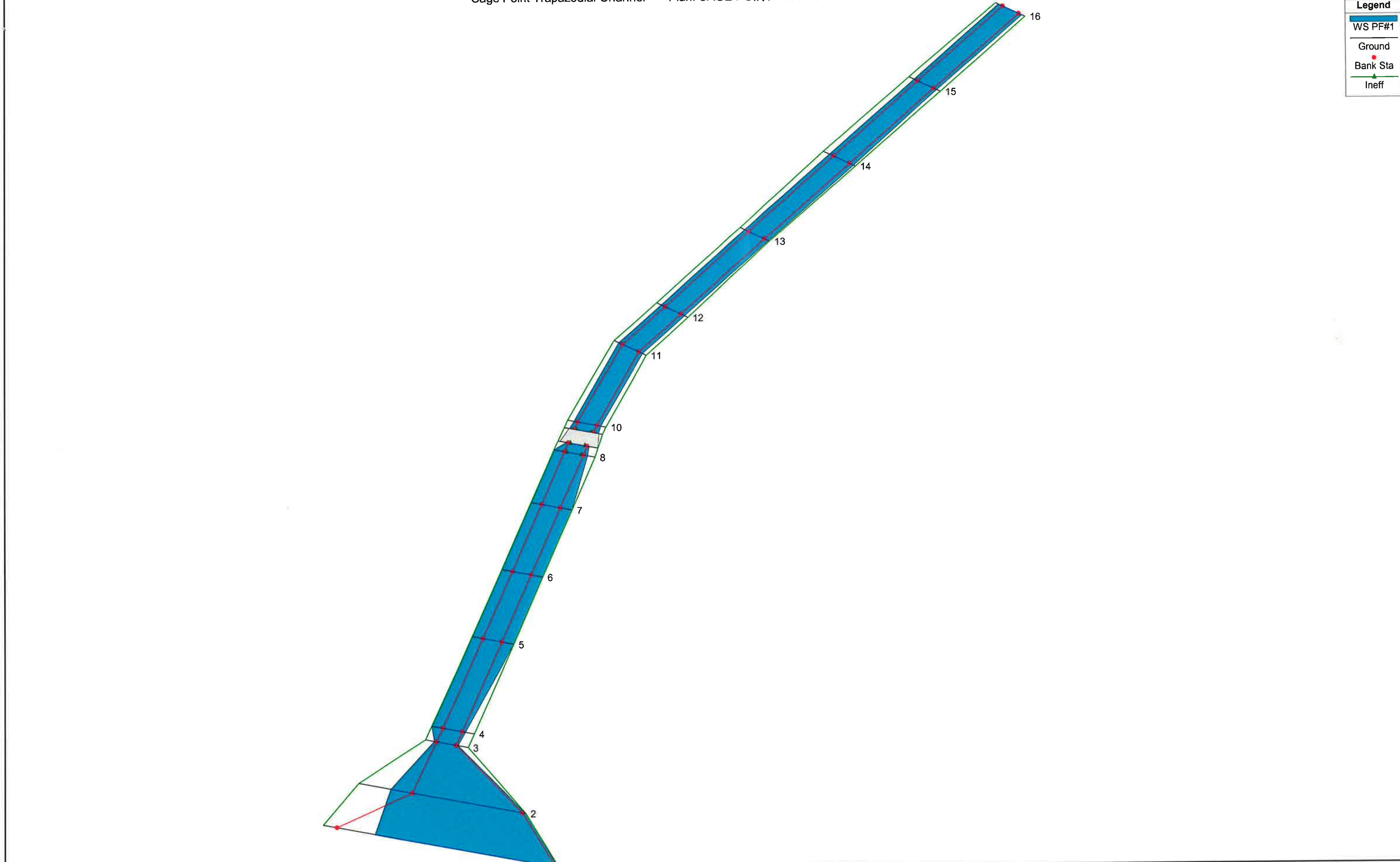

Stead Drainage Channel w/control sec
Plan: Apr 25 w/concrete
4/25/2005
Legend
W.S. Elev
4956.8
4956.7
4956.6
4956.5
4956.4
4956.3
4956.2
W.S. Elev (ft)
0
5
10
15
20
25
Q Total (cfs)

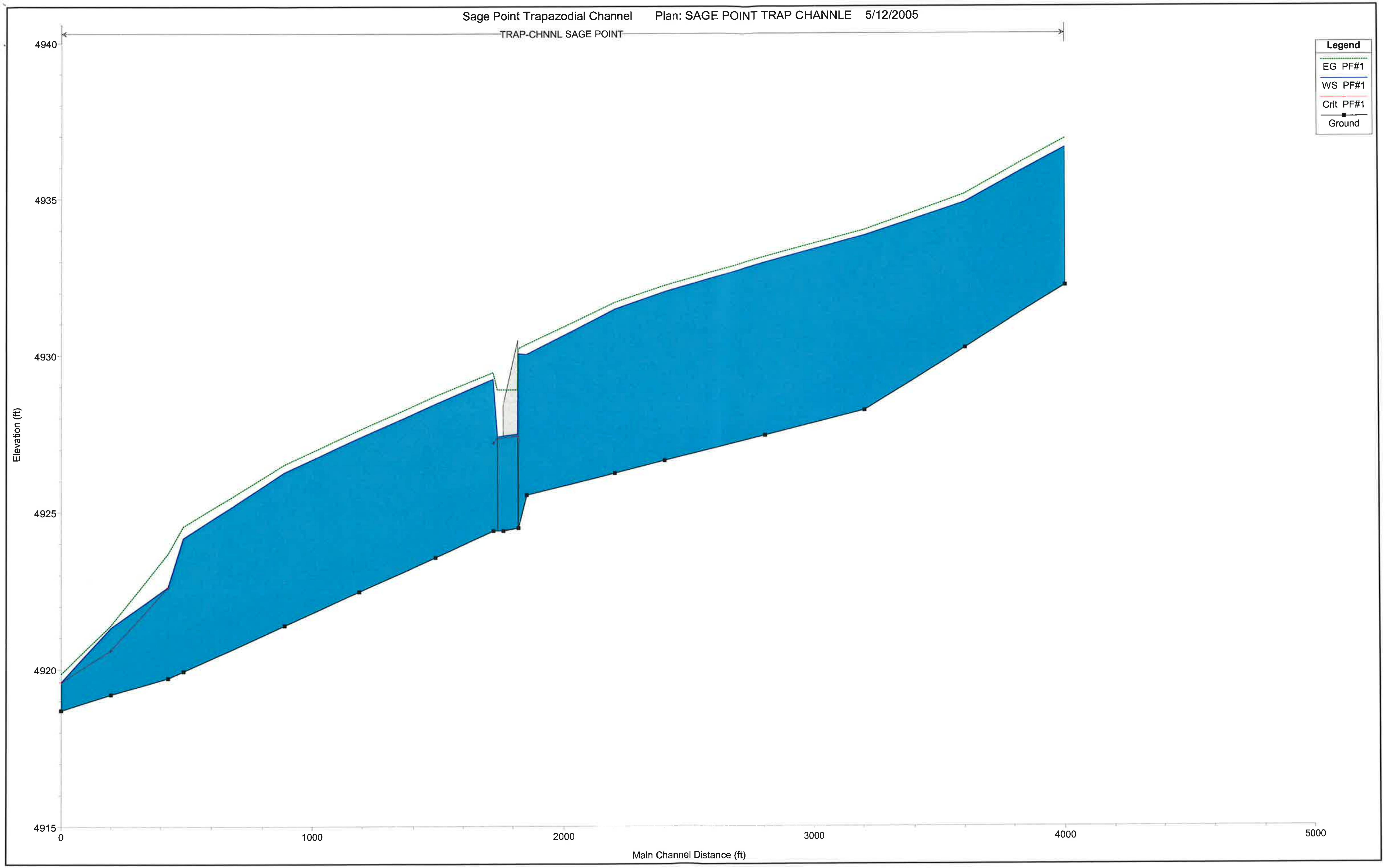
STA. 24.1

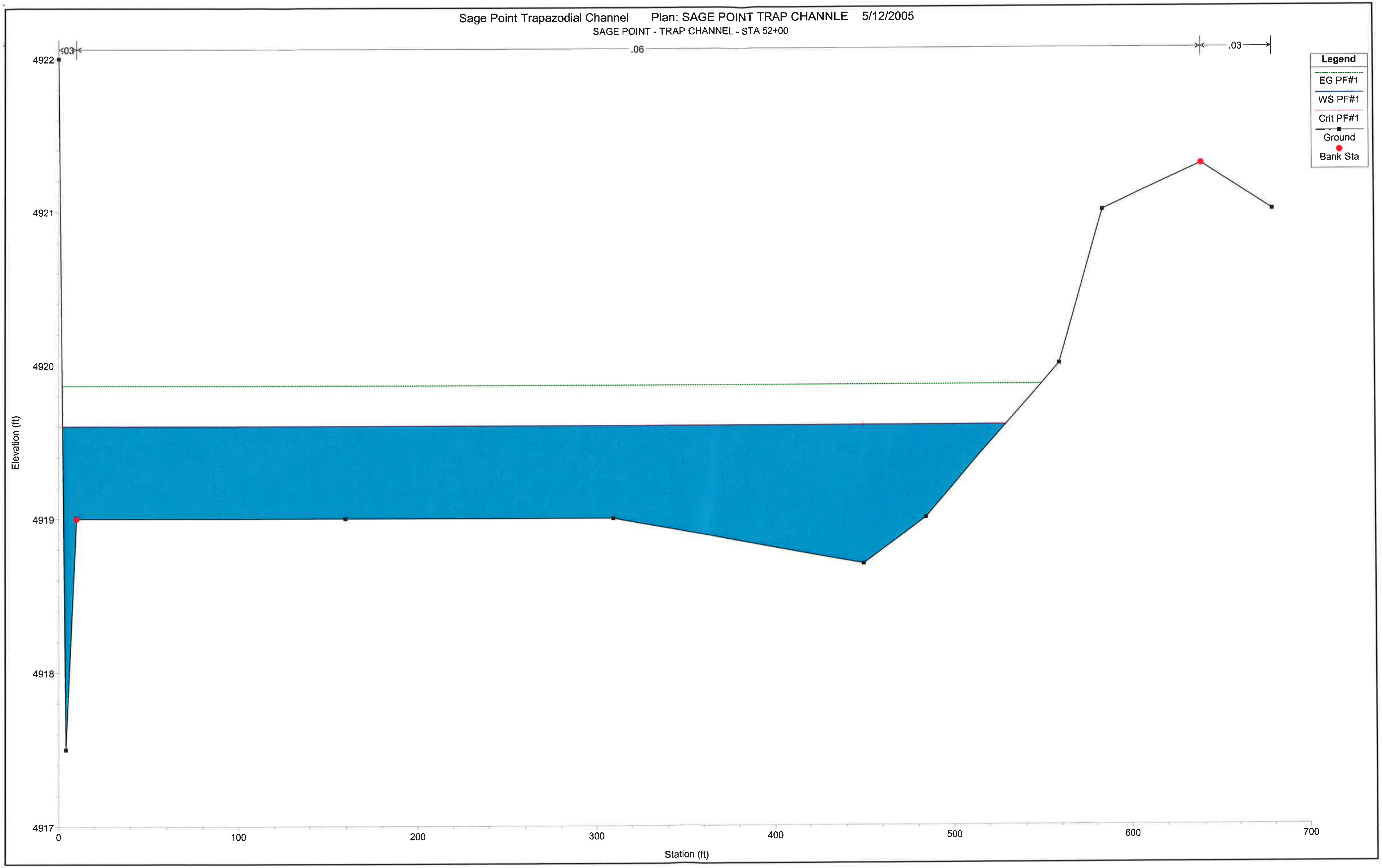

Stead Drainage Channel w/control sec Plan: Apr 25 w/concrete 4/25/2005
Legend
W.S. Elev
W.S. Elev (ft)
4957.4
4957.2
4957.0
4956.8
4956.6
4956.4
4956.2
0
5
10
15
20
25
Q Total (cfs)

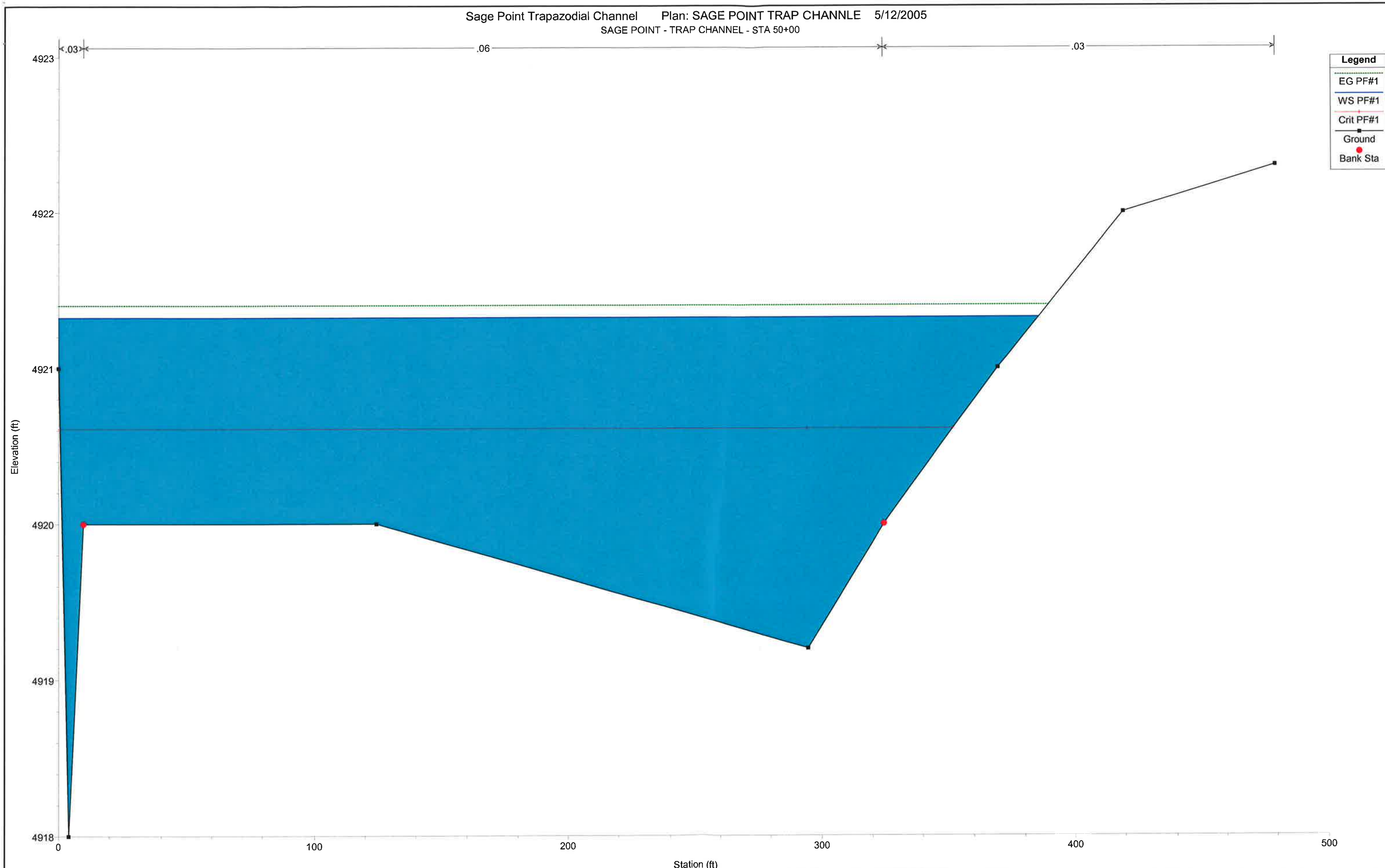
STA. 24.2

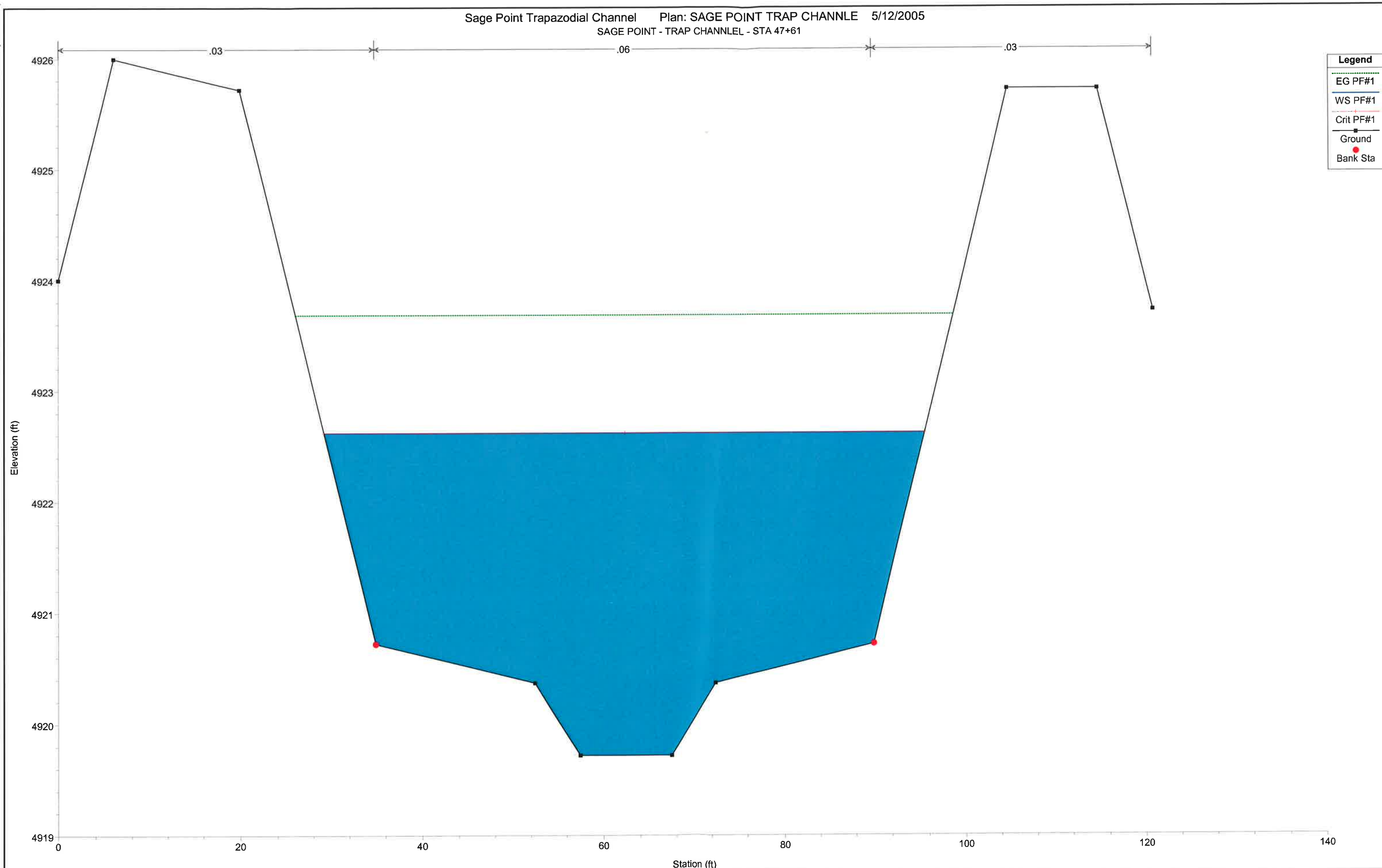
Sage Point Trapazodial Channel Plan: SAGE POINT TRAP CHANNLE 5/12/2005



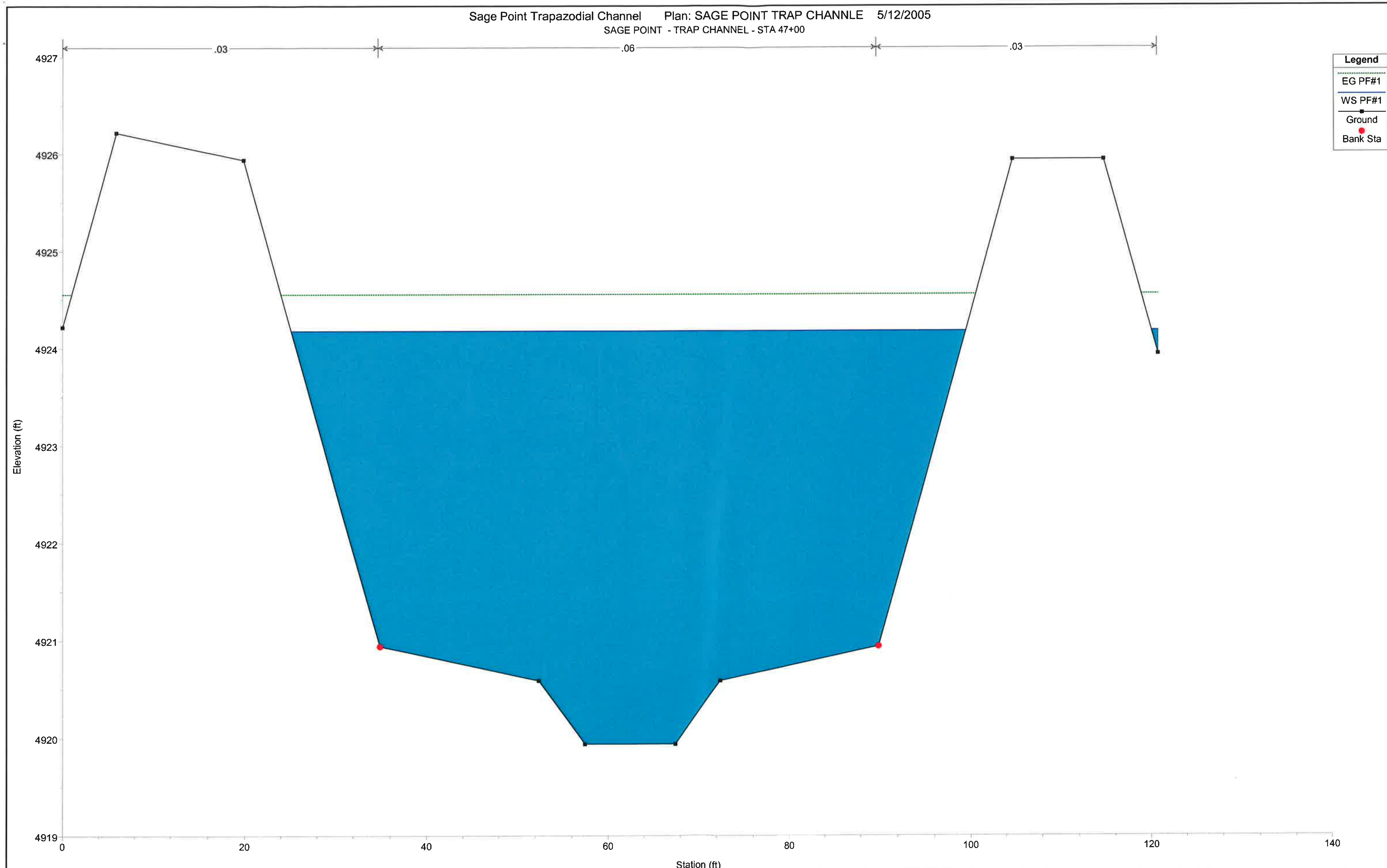

Sage Point Trapazodial Channel Plan: SAGE POINT TRAP CHANNLE 5/12/2005
TRAP-CHNNL SAGE POINT
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Elevation (ft)
4940
4935
4930
4925
4920
4915
0
1000
2000
3000
4000
5000
Main Channel Distance (ft)

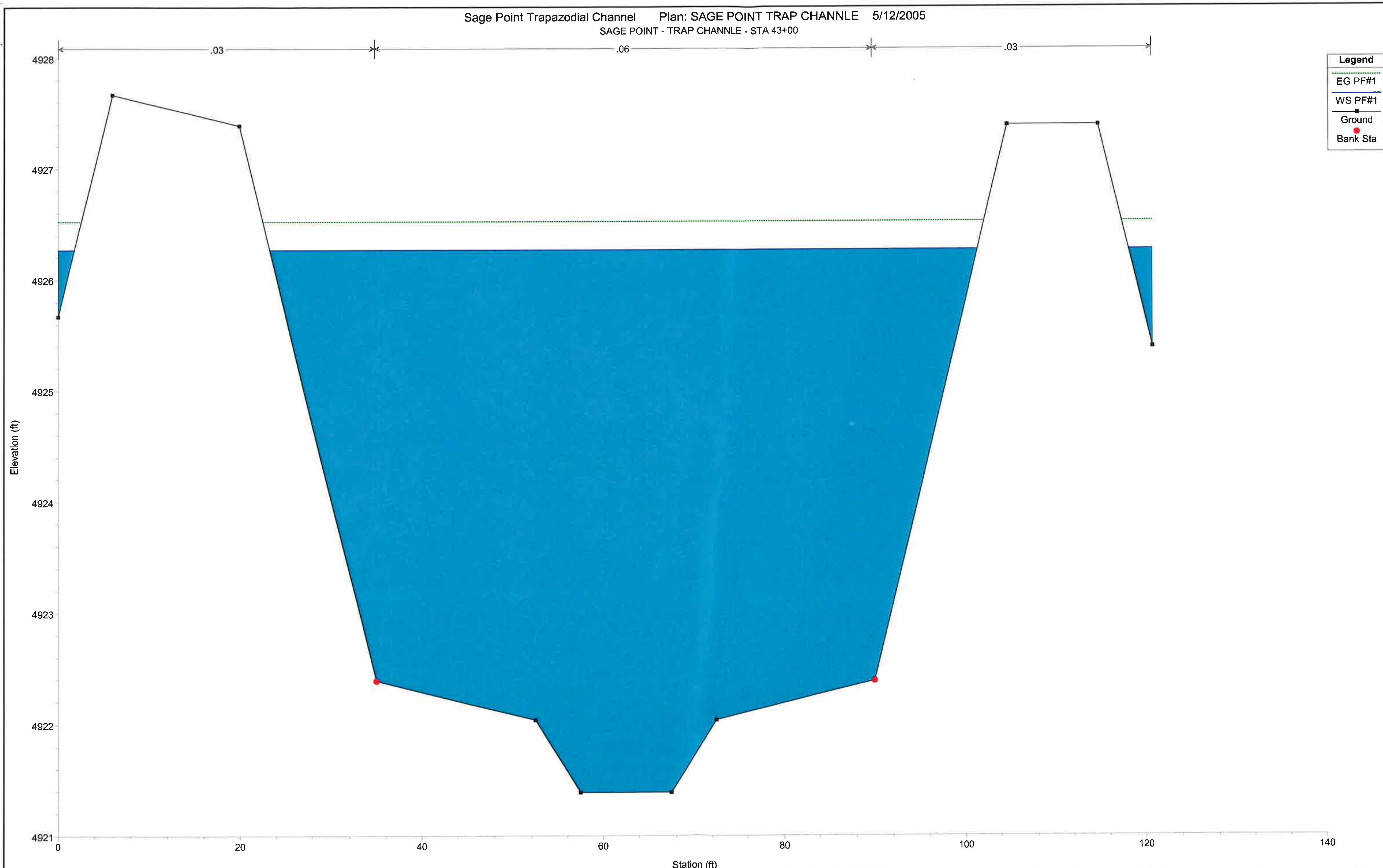

Sage Point Trapazodial Channel Plan: SAGE POINT TRAP CHANNLE 5/12/2005
SAGE POINT - TRAP CHANNEL - STA 52+00
.03
.06
.03
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
4922
4921
4920
4919
4918
4917
Elevation (ft)
0
100
200
300
400
500
600
700
Station (ft)


Sage Point Trapazodial Channel   Plan: SAGE POINT TRAP CHANNLE   5/12/2005
SAGE POINT - TRAP CHANNEL - STA 50+00
.03
.06
.03
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
4923
4922
4921
4920
4919
4918
0
100
200
300
400
500
Station (ft)

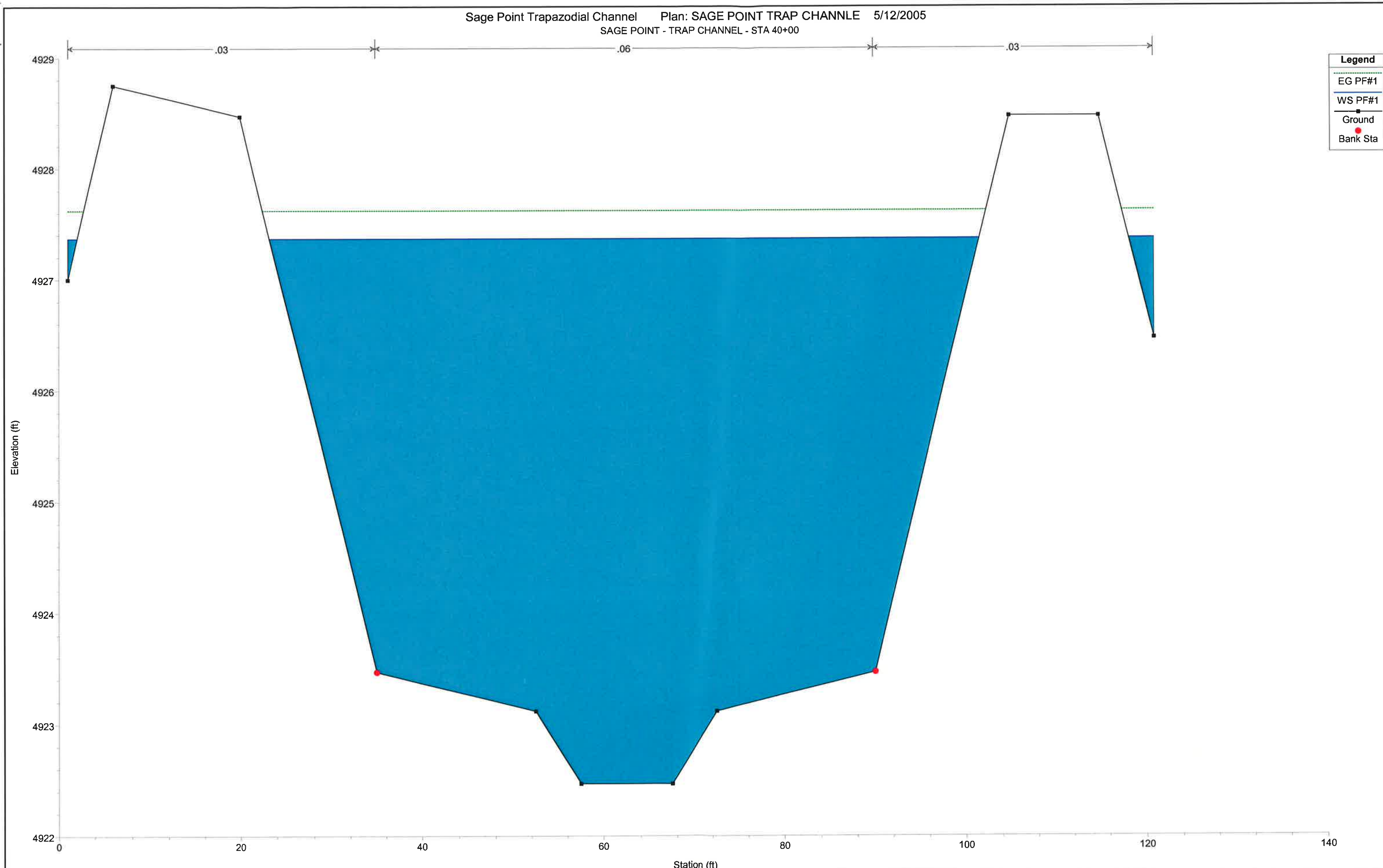


Sage Point Trapazodial Channel Plan: SAGE POINT TRAP CHANNLE 5/12/2005
SAGE POINT - TRAP CHANNLEL - STA 47+61
.03
.06
.03
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
4926
4925
4924
4923
4922
4921
4920
4919
Station (ft)
0
20
40
60
80
100
120
140

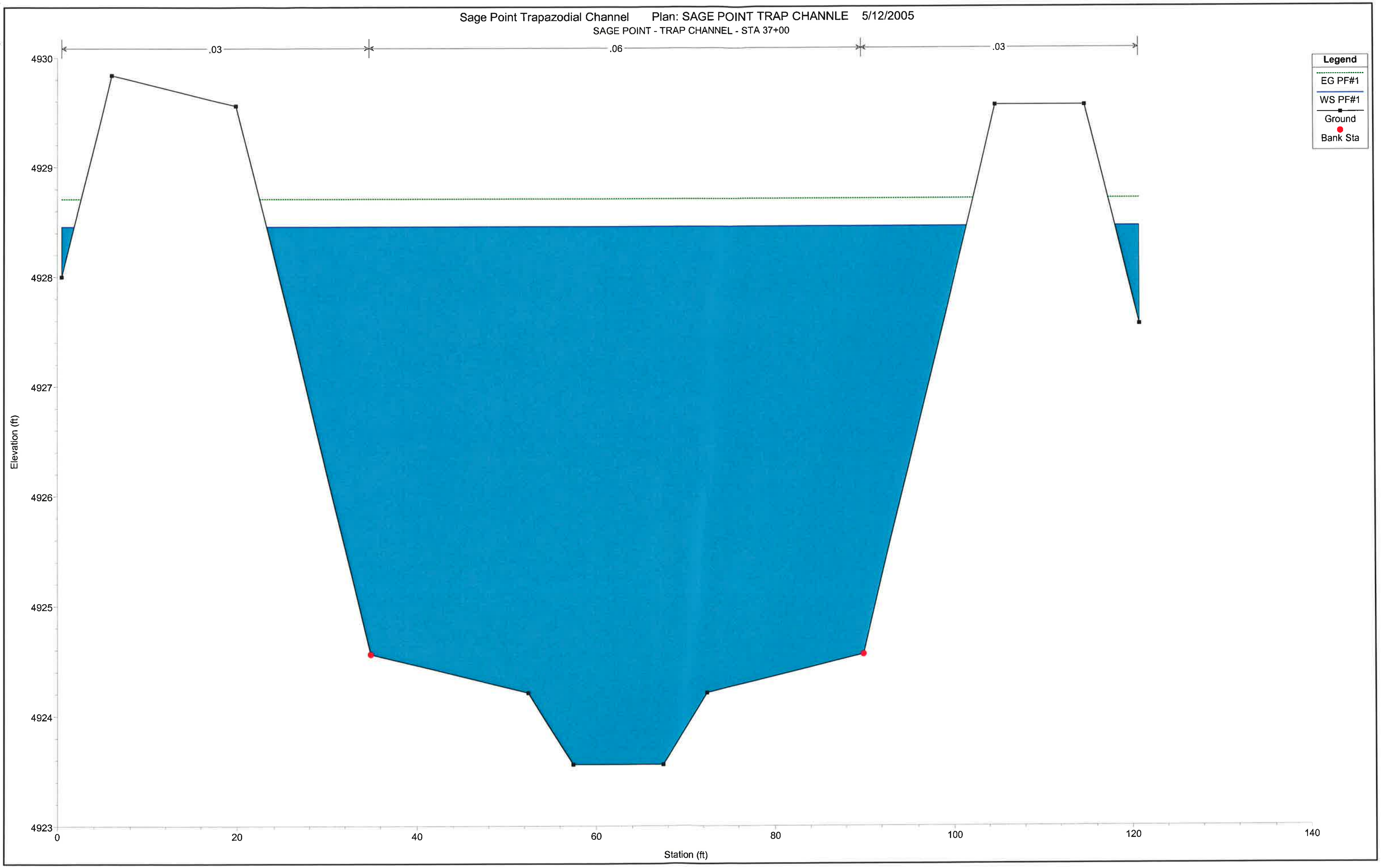

Sage Point Trapazodial Channel Plan: SAGE POINT TRAP CHANNLE 5/12/2005
SAGE POINT - TRAP CHANNEL - STA 47+00
.03
.06
.03
Legend
EG PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
4927
4926
4925
4924
4923
4922
4921
4920
4919
0
20
40
60
80
100
120
140
Station (ft)



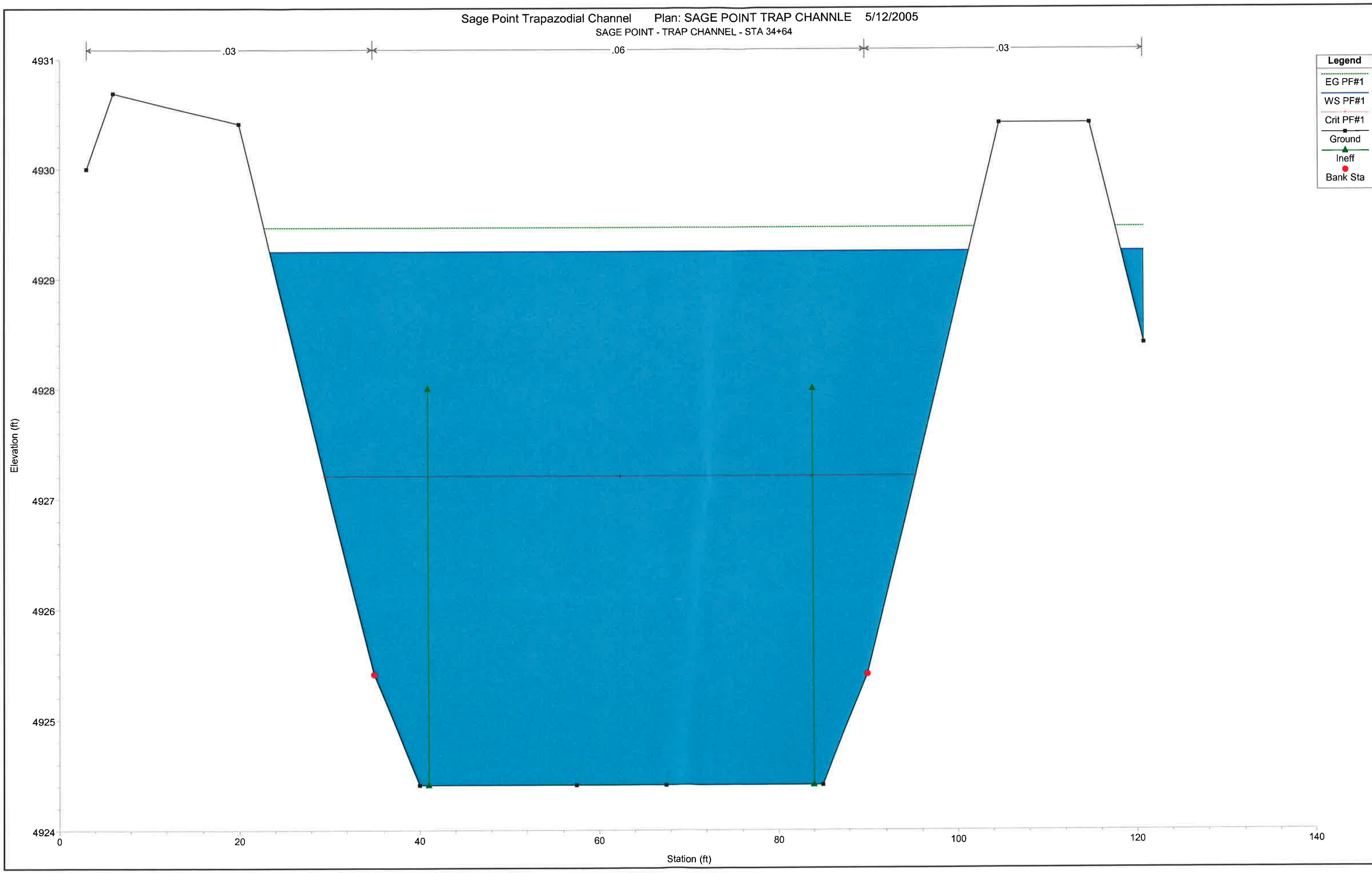
Sage Point Trapazodial Channel Plan: SAGE POINT TRAP CHANNLE 5/12/2005
SAGE POINT - TRAP CHANNLE - STA 43+00
.03
.06
.03
Legend
EG PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
4928
4927
4926
4925
4924
4923
4922
4921
0
20
40
60
80
100
120
140
Station (ft)

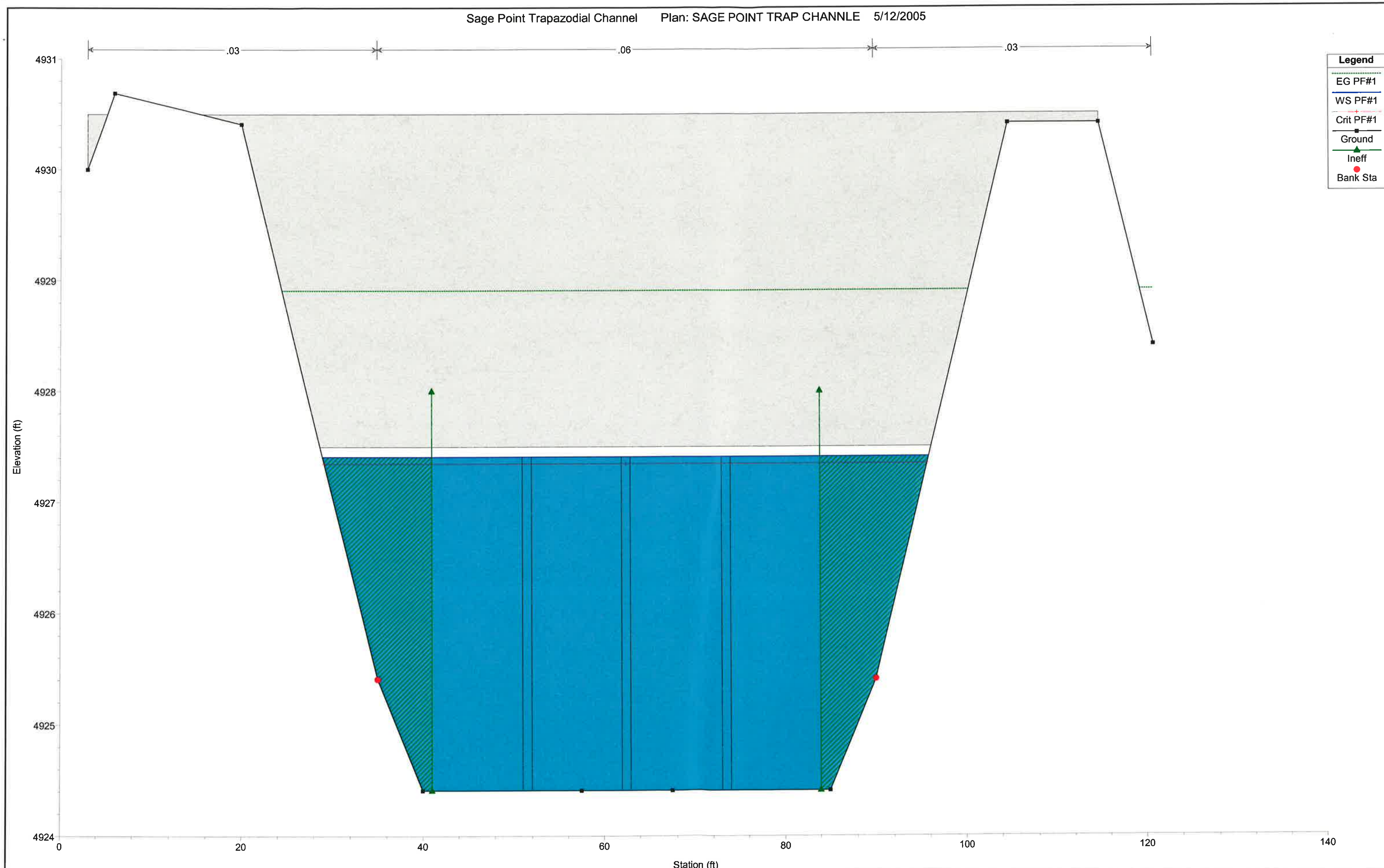


Sage Point Trapazodial Channel Plan: SAGE POINT TRAP CHANNLE 5/12/2005
SAGE POINT - TRAP CHANNEL - STA 40+00
.03
.06
.03
Legend
EG PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
4929
4928
4927
4926
4925
4924
4923
4922
0
20
40
60
80
100
120
140
Station (ft)

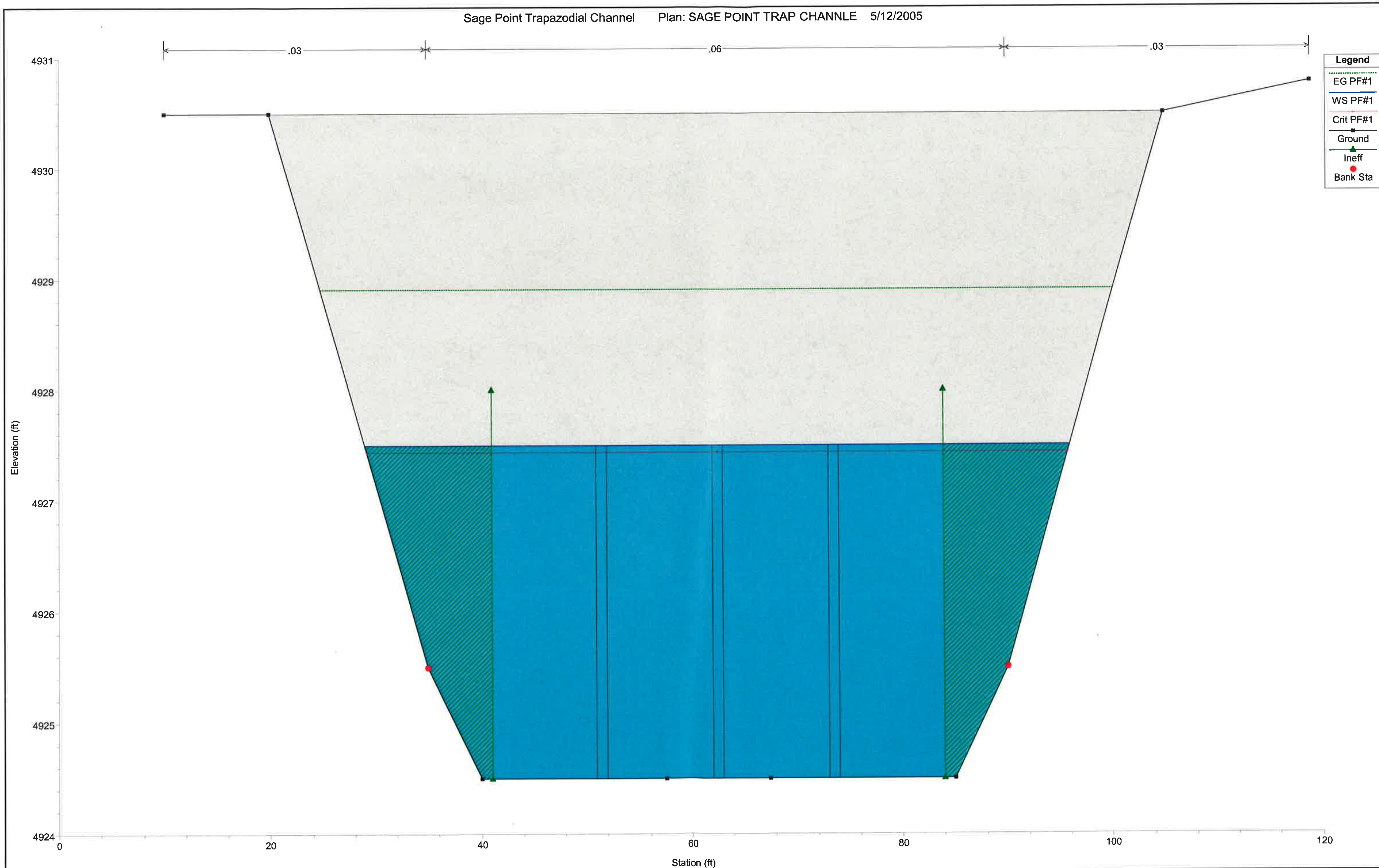


Sage Point Trapazodial Channel Plan: SAGE POINT TRAP CHANNLE 5/12/2005
SAGE POINT - TRAP CHANNEL - STA 37+00
.03
.06
.03
Legend
EG PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
4930
4929
4928
4927
4926
4925
4924
4923
0
20
40
60
80
100
120
140
Station (ft)

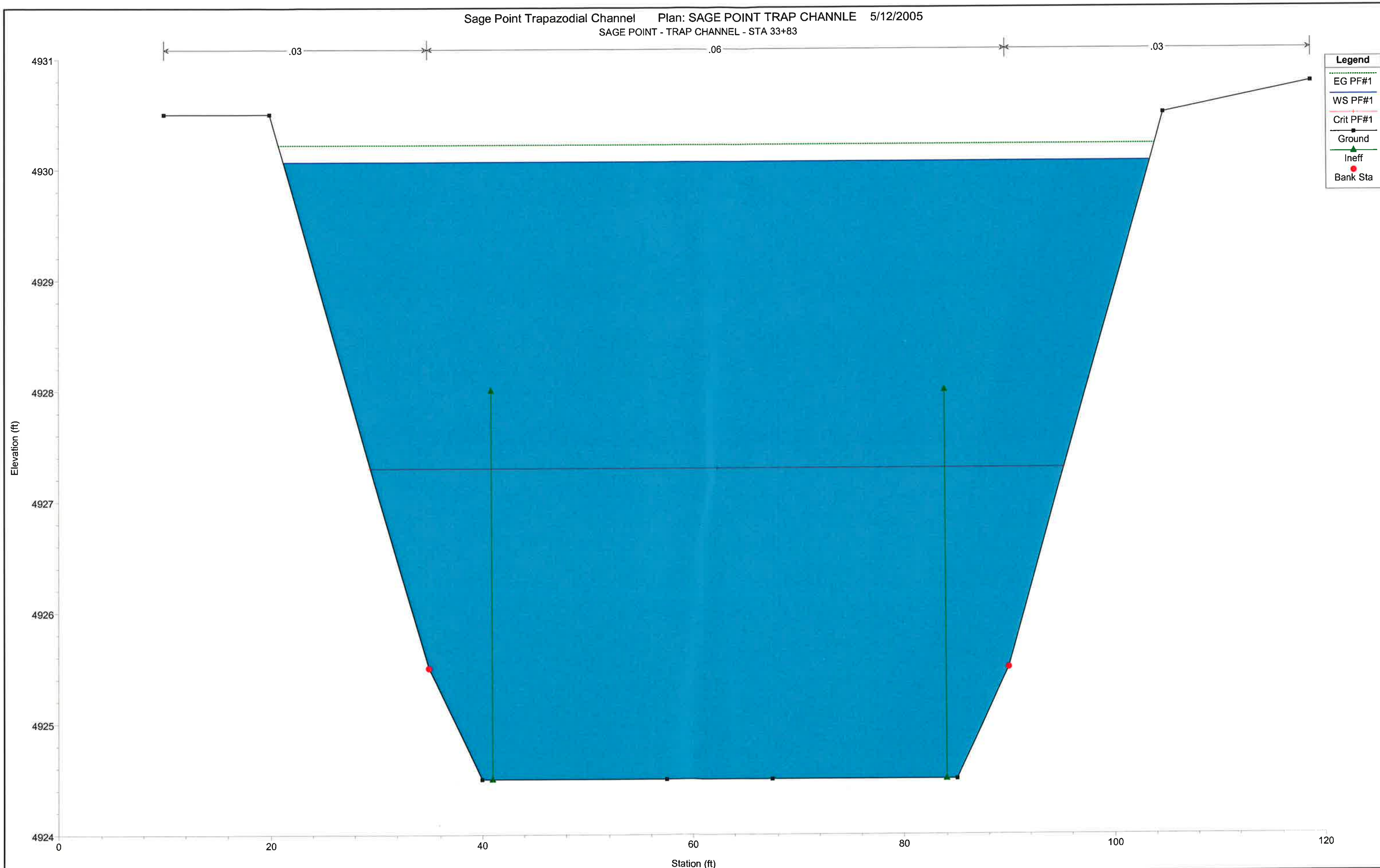

Sage Point Trapazodial Channel
Plan: SAGE POINT TRAP CHANNLE
5/12/2005
SAGE POINT - TRAP CHANNEL - STA 34+64
.03
.06
.03
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
4931
4930
4929
4928
4927
4926
4925
4924
0
20
40
60
80
100
120
140



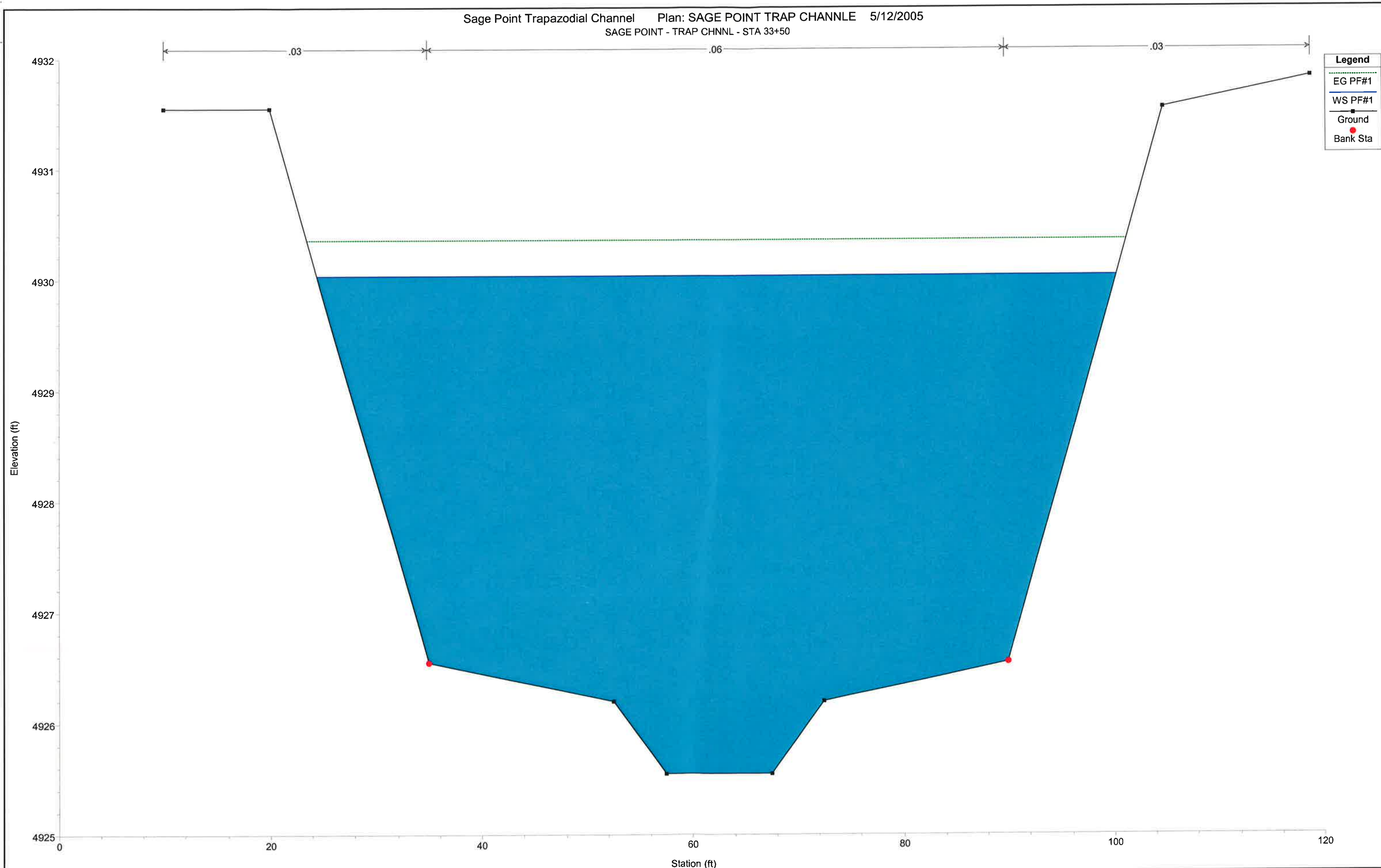
Sage Point Trapazodial Channel Plan: SAGE POINT TRAP CHANNLE 5/12/2005
.03
.06
.03
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
4931
4930
4929
4928
4927
4926
4925
4924
0
20
40
60
80
100
120
140



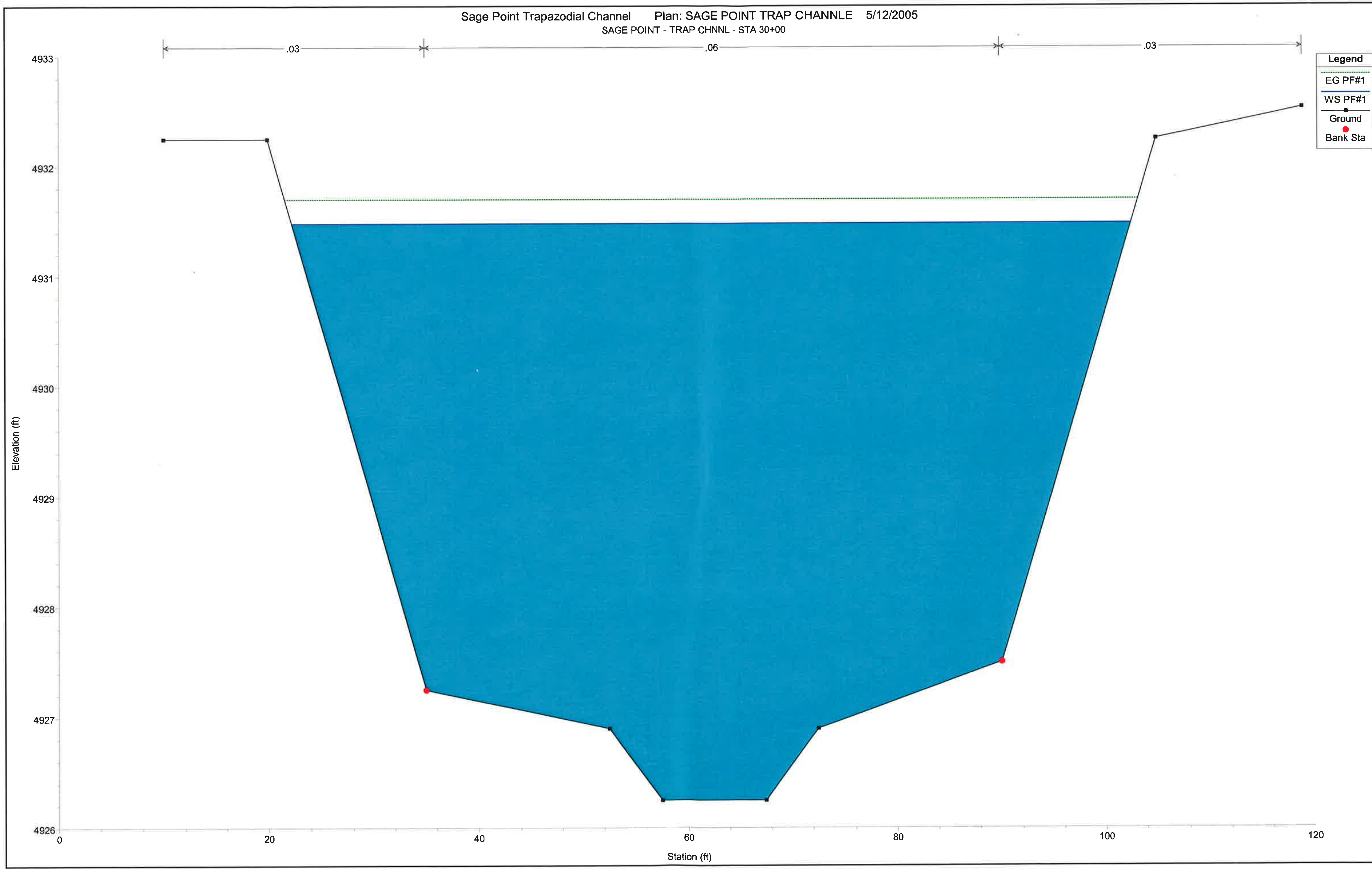
Sage Point Trapazodial Channel Plan: SAGE POINT TRAP CHANNLE 5/12/2005
.03
.06
.03
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Ineff
Bank Sta
4931
4930
4929
4928
4927
4926
4925
4924
Elevation (ft)
0
20
40
60
80
100
120
Station (ft)



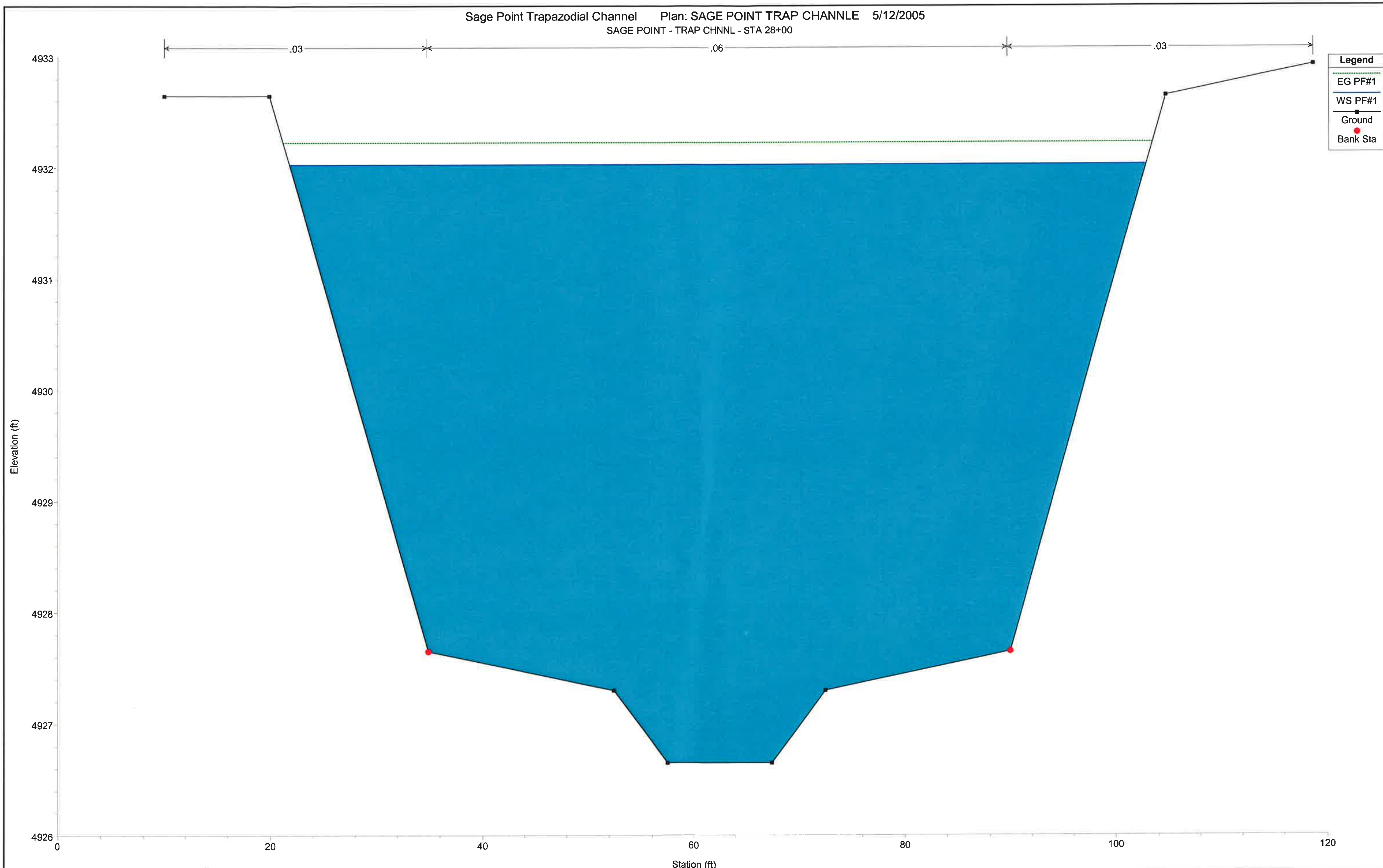
Sage Point Trapazodial Channel
Plan: SAGE POINT TRAP CHANNLE
5/12/2005
SAGE POINT - TRAP CHANNEL - STA 33+83
.03
.06
.03
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Ineff
Bank Sta
Elevation (ft)
4931
4930
4929
4928
4927
4926
4925
4924
0
20
40
60
80
100
120
Station (ft)



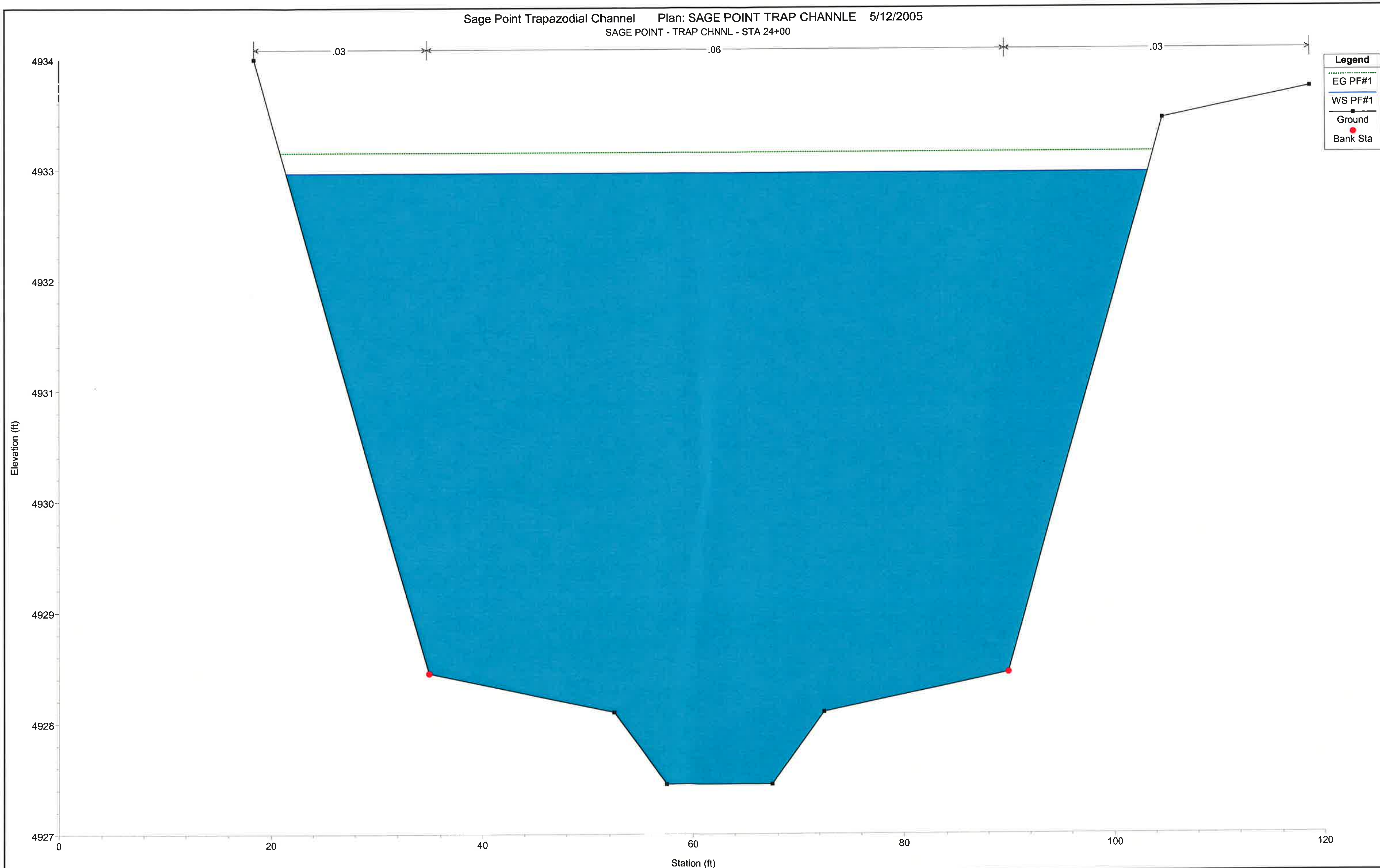
Sage Point Trapazodial Channel Plan: SAGE POINT TRAP CHANNLE 5/12/2005
SAGE POINT - TRAP CHNNL - STA 33+50
.03
.06
.03
Legend
EG PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
4932
4931
4930
4929
4928
4927
4926
4925
0
20
40
60
80
100
120
Station (ft)

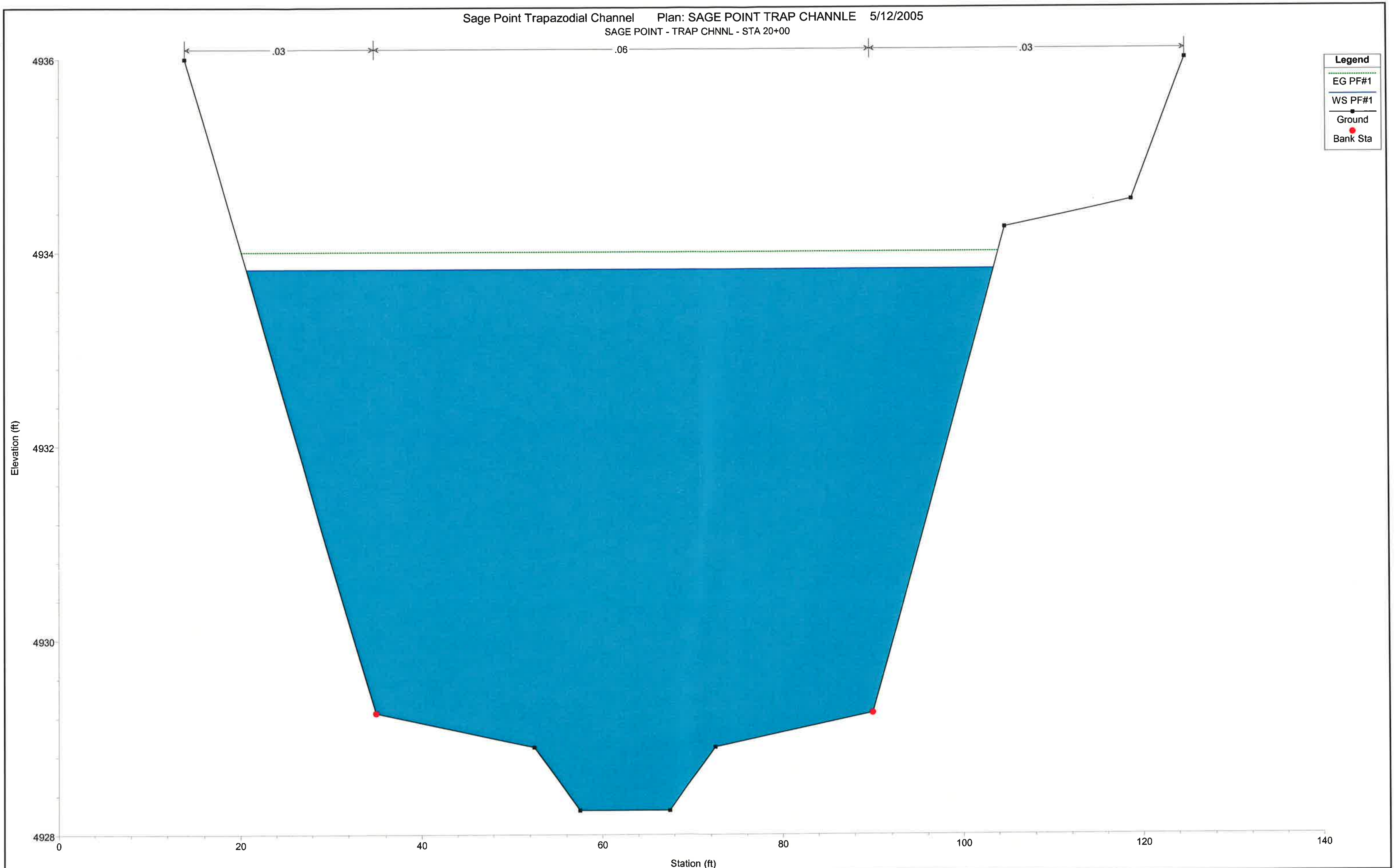


Sage Point Trapazodial Channel Plan: SAGE POINT TRAP CHANNLE 5/12/2005
SAGE POINT - TRAP CHNNL - STA 30+00
.03
.06
.03
Legend
EG PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
4933
4932
4931
4930
4929
4928
4927
4926
Station (ft)
0
20
40
60
80
100
120

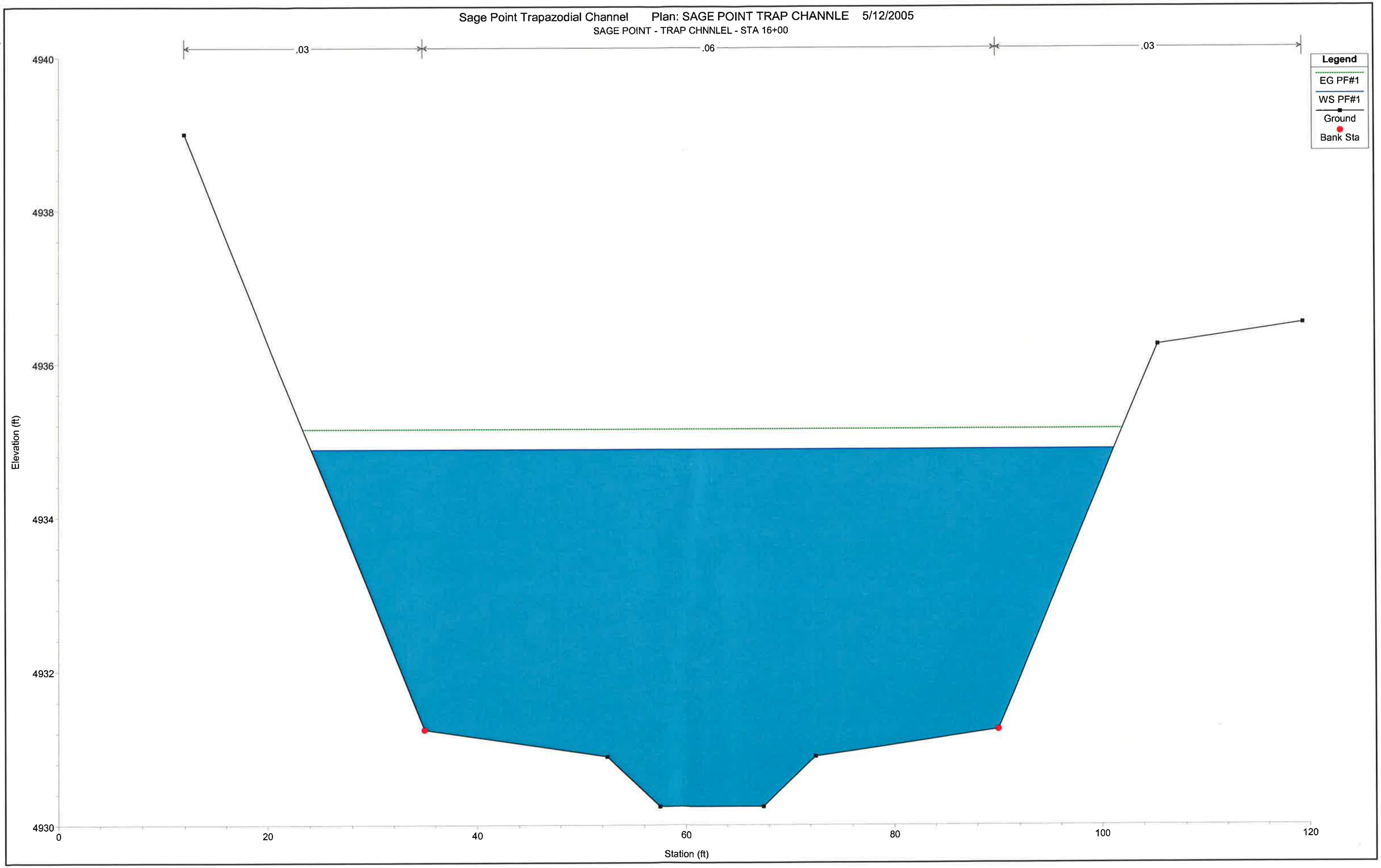


Sage Point Trapazodial Channel Plan: SAGE POINT TRAP CHANNLE 5/12/2005
SAGE POINT - TRAP CHNNL - STA 28+00
.03
.06
.03
Legend
EG PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
4933
4932
4931
4930
4929
4928
4927
4926
Station (ft)
0
20
40
60
80
100
120

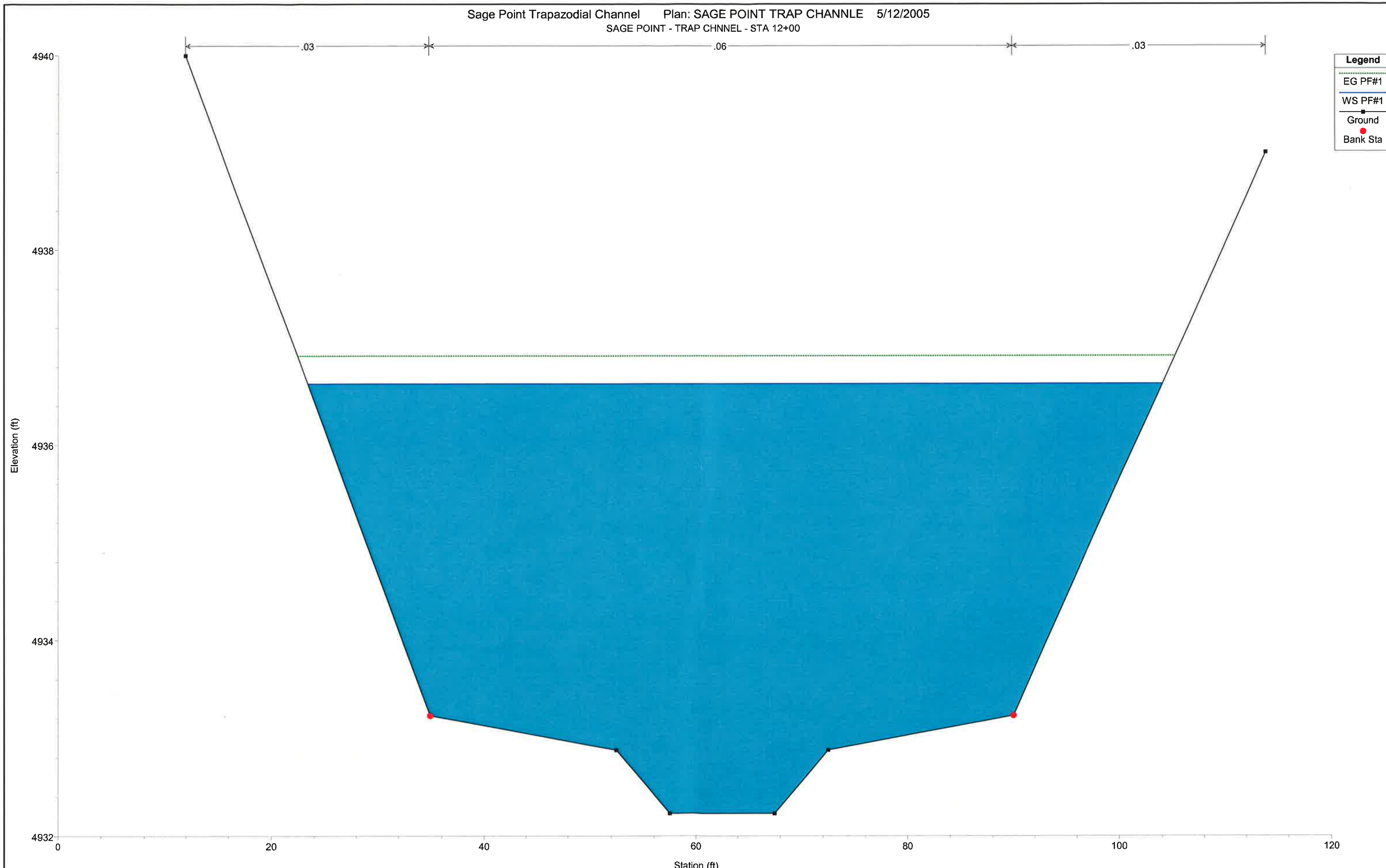

Sage Point Trapazodial Channel Plan: SAGE POINT TRAP CHANNLE 5/12/2005
SAGE POINT - TRAP CHNNL - STA 24+00
.03
.06
.03
Legend
EG PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
4934
4933
4932
4931
4930
4929
4928
4927
0
20
40
60
80
100
120
Station (ft)



Sage Point Trapazodial Channel Plan: SAGE POINT TRAP CHANNLE 5/12/2005
SAGE POINT - TRAP CHNNL - STA 20+00
.03
.06
.03
Legend
EG PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
4936
4934
4932
4930
4928
0
20
40
60
80
100
120
140
Station (ft)



Sage Point Trapazodial Channel
Plan: SAGE POINT TRAP CHANNLE
5/12/2005
SAGE POINT - TRAP CHNNLEL - STA 16+00
.03
.06
.03
Legend
EG PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
4940
4938
4936
4934
4932
4930
0
20
40
60
80
100
120
Station (ft)


Sage Point Trapazodial Channel Plan: SAGE POINT TRAP CHANNLE 5/12/2005
SAGE POINT - TRAP CHNNEL - STA 12+00
.03
.06
.03
Legend
EG PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
4940
4938
4936
4934
4932
0
20
40
60
80
100
120
Station (ft)