Star Point Mine
Plateau Mining Corporation
C/007/006

Phase I Bond Release Application

November 6, 2003

For additional information
File in:
☐ Confidential
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Refer to Record No. 0027 Date 11062003
In C/0070006 2003 Incoming
For additional information

0027

Mine # C/007/006
File Incoming
Record # 0027
Doc. Date 11-06-03
Recd. Date 11-10-03

PLATEAU MINING CORPORATION

Willow Creek Mine
PO Box 30
847 NW Hwy 191
Helper, Utah 84526
(435) 472-0475
Fax: (435) 472-4782

An affiliate of RAG

November 6, 2003

INCOMING
C0070006
Task ID# 1768

Ms. Pamela Grubaugh-Littig
Utah Division of Oil, Gas and Mining
1594 West North Temple, Suite 1210
P.O. Box 145801
Salt Lake City, Utah 84114-5801

Re: Phase I Bond Release Application, Star Point Mine, Plateau Mining Corporation, C/007/006, Carbon County, Utah

Dear Ms. Grubaugh-Littig:

Plateau Mining Corporation (PMC) is submitting its application for Phase I Bond Release for its Star Point Mine. As the Division knows, the Star Point Mine ceased operation in February 2000. Demolition activities commenced shortly thereafter on the overland conveyance and processing facilities. Sealing, backfilling, and reseeding of the remote fan site locations in Corner Canyon and Mudwater Canyon were accomplished in the Fall of 2000 as were the sealing of the Lion Deck portals.

In 2001, demolition work continued with the razing of the unit train loadout and subsequent backfilling and grading of the immediate and adjacent areas. Also in 2001, the No.1 Mine Road area was backfilled and graded. All requisite backfilling and grading work, channel construction, soil preparation and revegetation activities were also accomplished in sequence.

2002 brought forth the final demolition of the remaining structures, which included the Lion Deck bathhouse, warehouse, and shop, and subsequent backfilling and grading, channel construction, soil preparation, and revegetation of the remaining areas - the lion deck, overland conveyor, and main channel. During the growth media placement over the coal processing waste backfill material, every effort was made to ensure at least four-feet of suitable growth media was placed over the backfill.

Also during 2002, a post mining land use change was permitted and achieved to facilitate the installation of two coal bed methane wells and utility corridor by ConocoPhillips within PMC's permit area. As part of the post mining land use change, a portion of the disturbed land was reclaimed to facilitate the gas wells and utility corridor.

The attached application includes: as-built topography and treatment maps, as-built reclamation cross-sections, as-built reclamation watersheds and diversions, as-built reclamation channel cross-sections, text page replacements, as-built hydrology calculations and construction, proposed public notice, notification letters to landowners, state, federal, and local government agencies, and a reclamation certification.

As-built topography, except for Corner and Mudwater Canyon fan sites, was generated from aerial photography taken this June. Whenever possible, aerial photography is the preferred and least expensive method for generating surface topography be it pre-mining, operation, or reclamation.

RECEIVED
NOV 10 2003
DIV. OF OIL, GAS & MINING

The public notice discusses bonding numbers which may vary upon approval of SCA's permitting action; therefore, the dollar amounts will be revised at the appropriate time. With regards to SCA, the maps and some of the enclosed text addresses SCA as it was submitted during that permitting action. Hopefully, by the time this is reviewed, the SCA permitting action will be finalized.

PMC believes that it has assembled a complete phase I bond release application that adequately addresses the requirements for bond release. A timely review of this application and authorization to place the public notice in the newspaper would be most appreciated.

Furthermore, an onsite inspection within 30-days of acceptance of the application, or as soon thereafter as weather conditions permit, to inspect and evaluate the reclamation would also be most appreciated. PMC would also like to have the bottlenecks that have plagued current and previous bond release approvals addressed in a manner that is appropriate and takes into account the permittee's needs to reduce bonding expenses.

If the Division has any questions or needs additional information, please do not hesitate to contact me at (435) 472-4741.

Sincerely,

Johnny Pappas
Sr. Environmental Engineer

Enclosures

File: Star Point Mine – Phase I Bond Release Application
Chron.: JP031101.ltr

APPLICAT N FOR COAL PERMIT PROCESS G

Permit Change ☐ New Permit ☐ Renewal ☐ Exploration ☐ Bond Release ☒ Transfer ☐

Permittee: Plateau Mining Corporation
Mine: Star Point Mine **Permit Number:** C/007/006
Title: Phase I Bond Release
Description, Include reason for application and timing required to implement:
Phase I requirements achieved and request for 60% bond reduction

Instructions: If you answer yes to any of the first eight (gray) questions, this application may require Public Notice publication.

☐ Yes ☒ No 1. Change in the size of the Permit Area? Acres: _____ Disturbed Area: _____ ☐ increase ☐ decrease.
☐ Yes ☒ No 2. Is the application submitted as a result of a Division Order? DO# _____
☐ Yes ☒ No 3. Does the application include operations outside a previously identified Cumulative Hydrologic Impact Area?
☐ Yes ☒ No 4. Does the application include operations in hydrologic basins other than as currently approved?
☒ Yes ☐ No 5. Does the application result from cancellation, reduction or increase of insurance or reclamation bond?
☒ Yes ☐ No 6. Does the application require or include public notice publication?
☐ Yes ☒ No 7. Does the application require or include ownership, control, right-of-entry, or compliance information?
☐ Yes ☒ No 8. Is proposed activity within 100 feet of a public road or cemetery or 300 feet of an occupied dwelling?
☐ Yes ☒ No 9. Is the application submitted as a result of a Violation? NOV # _____
☐ Yes ☒ No 10. Is the application submitted as a result of other laws or regulations or policies?
Explain: _____
☐ Yes ☒ No 11. Does the application affect the surface landowner or change the post mining land use?
☐ Yes ☒ No 12. Does the application require or include underground design or mine sequence and timing? (Modification of R2P2)
☐ Yes ☒ No 13. Does the application require or include collection and reporting of any baseline information?
☐ Yes ☒ No 14. Could the application have any effect on wildlife or vegetation outside the current disturbed area?
☒ Yes ☐ No 15. Does the application require or include soil removal, storage or placement?
☒ Yes ☐ No 16. Does the application require or include vegetation monitoring, removal or revegetation activities?
☒ Yes ☐ No 17. Does the application require or include construction, modification, or removal of surface facilities?
☐ Yes ☒ No 18. Does the application require or include water monitoring, sediment or drainage control measures?
☒ Yes ☐ No 19. Does the application require or include certified designs, maps or calculation?
☐ Yes ☒ No 20. Does the application require or include subsidence control or monitoring?
☐ Yes ☒ No 21. Have reclamation costs for bonding been provided?
☐ Yes ☒ No 22. Does the application involve a perennial stream, a stream buffer zone or discharges to a stream?
☐ Yes ☒ No 23. Does the application affect permits issued by other agencies or permits issued to other entities?

Please attach four (4) review copies of the application. If the mine is on or adjacent to Forest Service land please submit five (5) copies, thank you. (These numbers include a copy for the Price Field Office)

I hereby certify that I am a responsible official of the applicant and that the information contained in this application is true and correct to the best of my information and belief in all respects with the laws of Utah in reference to commitments, undertakings, and obligations, herein.

JOHNNY PAPPAS
Print Name

Sr. Env. Engineer - 11/04/03
Sign Name, Position, Date

Subscribed and sworn to before me this 4th day of November, 2003

Wilma Howa
Notary Public

My commission Expires: 9/5, 2004
Attest: State of Utah } } ss:
County of Carbon

NOTARY PUBLIC
WILMA HOWA
70 South Main
Helper, Utah 84526
My Commission Expires
September 05, 2004
STATE OF UTAH

For Office Use Only:	Assigned Tracking Number:	Received by Oil, Gas & Mining
		RECEIVED NOV 1 0 2003 DIV. OF OIL, GAS & MINING

Form DOGM- C1 (Revised March 12, 2002)

Plateau Mining Corporation
Star Point Mine
C/007/006

Phase I Bond Release on 95.3 acres of disturbed lands associated with the Star Point Mine

I hereby certify to the best of my information and belief that all applicable reclamation activities have been accomplished in accordance with the requirements of the Act, the regulatory program, and the approved reclamation plan.

JOHNNY PAPPAS
Print Name

[signature] - Sr. Env. Engineer - 11/04/03
Sign Name, Position, Date

Subscribed and sworn to before me this 4th day of November, 2004

Wilma Howa
Notary Public

My Commission Expires: 9/5, 2004 }

Attest: State of Utah } } ss:

County of Carbon

NOTARY PUBLIC
WILMA HOWA
70 South Main
Helper, Utah 84526
My Commission Expires
September 05, 2004
STATE OF UTAH

LIST OF MAPS

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No surface coal mining and reclamation activities have or will be conducted within the permit area.

541.300. UNDERGROUND COAL MINING AND RECLAMATION ACTIVITIES.

All surface equipment, structures, or other facilities not required for continued underground mining activities and monitoring, unless approved by the Division as suitable for the post-mining land use or environmental monitoring, will be removed and the affected lands reclaimed following permanent cessation of mining operations.

541.400. ENVIRONMENTAL PROTECTION PERFORMANCE STANDARDS.

The plan presented herein is designed to meet the requirements of R645-301 and the environmental protection performance standards of the State Program.

542. NARRATIVES, MAPS AND PLANS.

542.100. RECLAMATION TIMETABLE.

Reclamation of the Refuse Pile, topsoil borrow, and subsoil stockpile sites referred to within this Plan are superseded with the information presented in Sunnyside Cogeneration Associates' Permit C/007/042.

A detailed timetable for the completion of each major step in the reclamation plan is included as Table 542.100a and Figure 5-1 in Exhibit 233. Table 542.100a projects completion of the reclamation within a 2-year period. However, specifics related to the duration and sequencing of reclamation construction activities will be dependent largely upon contractor preference and equipment. Therefore, selected tasks may shift and the time frame may be extended beyond that indicted in Table 542.100a (up to a total potential duration of 5 years).

542.200. PLAN FOR BACKFILLING, SOIL STABILIZATION, COMPACTING, AND GRADING.

The Star Point regrading plan was designed to meet the objectives of balancing cut and fill quantities, maintaining a geotechnically stable site, and minimizing erosion. The primary features of the regrading plan are:

- Regrading of areas to create slopes which will adequately drain while minimizing long-term erosion concerns;
- Backfilling to remove highwalls and cut slopes to the extent possible within the objectives noted above (cut and fill balance, site stability, and erosion control), recognizing the presence of pre-SMCRA slopes where available on-site materials will not allow complete removal of the highwalls and cut slopes;
- Construction of stable channels across regraded areas; and
- Removal of sedimentation ponds and implementation of interim sediment control.

The ~~estimated~~ as-built cut quantity for the Star Point facility is ~~789,910~~ 667,673 cubic yards, with a ~~n estimated~~ fill of ~~315,532~~ 442,826 cubic yards (see Table 542.200a). The difference between these two quantities ~~is anticipated to be~~ was balanced by placing at the Lion Deck ~~or~~ and Refuse Pile. Regrading activities ~~will~~ continued until the final surface configuration was achieved as shown on ~~defined by~~ Maps 542.200a through 542.200h ~~i is approximated~~. Details regarding topsoil placement and revegetation following regrading are provided in Chapters 200 and 300 of this M&RP, respectively. Any plans presented in this section that are not consistent with information presented in Exhibit 528.322d supercede the information in Exhibit 528.322d.

TABLE 542.200a
AS-BUILT CUT and FILL BALANCE[a]

Area	Cut Quantity (yd^3)	Fill Quantity (yd^3)	Difference (yd^3)
Lion Deck	~~59,771~~ 83,902	~~153,901~~ 182,734	~~+94,138~~ 98,832
Pond 1	~~39,398~~ 29,906	~~29,641~~ 24,075	- ~~9,757~~ 5,831
Pond 2	~~9,600~~ 14,656	~~9,667~~ 14,415	~~+67~~ -241
Main channel and lower facilities	~~582,382~~ 419,764	~~28,803~~ 96,459	- ~~553,579~~[b] 323,305
Refuse pile [1]			
No. 1 and 2 Mine roads	~~12,600~~ 32,801	~~12,600~~ 31,557	~~0~~ +1,244
No. 1 Mine	~~41,646~~ 54,864	~~41,723~~ 57,352	+ ~~77~~ 2,488
No. 2 Mine	~~4,039~~ 1,137	~~5,681~~ 1,780	+ ~~1,642~~ 643
Lion Deck road repair	~~12,600~~ 2320	~~12,600~~ 2320	0
Exploration road	1,566	1,566	0
Pond 6 [1]			
Pond 7	~~215~~ 1,589	~~493~~ 196	~~+278~~ -1,393
Pond 8	~~6,795~~ 3,824	~~7,159~~ 3,157	~~+364~~ -667
Subsoil stockpile [1]			
Refuse pile test plots [1]			
Topsoil pile north of test plots	~~8,500~~ 14,117	~~0~~ 819	- ~~8,500~~[c] 13,298
Unit train loadout area and conveyor	~~5,100~~ 5,561	~~6,000~~ 17,287	+ ~~900~~ 11,726
Mudwater Canyon fan portal	~~2,506~~ 1,659	~~2,506~~ 2,965	~~0~~ +1,306
Corner Canyon fan portal	~~1,375~~ 7.0	~~1,375~~ 6,144	~~0~~ +6,137
Little Park fan portal [d]			
Total	~~789,910~~ 667,673	~~315,532~~ 442,826	- ~~474,378~~ 224,847

[1] Permitted by Sunnyside Cogeneration Associates (SCA) under Permit C/007/042
[a] Caluclated using Softdesk® Civil/Survey, Version 7.5-7.6
[b] Material to be moved to Lion Deck and Refuse Pile (SCA Agreement)
[c] Material to be used in reclamation of the Main Channel and/or Lion Deck areas
[d] Little Park fan portal was never constructed.

Revised: 11/03

the mulch), the erosion rate is estimated to vary from 3.8 to 36.3 tons per acre per year (a 53 percent reduction compared to pre-mining conditions). Hence, reclamation of the area will reduce soil loss below that estimated to have occurred prior to disturbance, even with the concurrent removal of the sedimentation ponds during reclamation.

If reclamation work is not completed before seasonal conditions require a halt to reclamation work, those areas which have been regraded but which have not been topsoiled and reseeded will be deep gouged and left in a roughened state until reclamation activities resume.

542.300. FINAL SURFACE CONFIGURATION MAPS AND CROSS SECTIONS.

Final surface configuration maps and cross sections for the Star Point site are provided on Maps 542.200a through 542.200h ~~i~~ and Drawing 5-2 through 5-4. County Road 290, which accesses the lands west of the surface facilities will remain following reclamation (see Section 542.600). No other facilities related to the coal mining operations will remain in the permit area following reclamation.

542.400. REMOVAL OF TEMPORARY STRUCTURES.

All surface structures associated with the mining operation will be removed as outlined in Section 542.200. A description ensuring that all structures and the sedimentation pond have been removed will be provided to the Division before seeking bond release or abandoning the permit area.

542.500. REMOVAL OF SEDIMENTATION PONDS.

Information regarding removal of the sedimentation ponds associated with the Star Point Mines is provided in Section 542.200. The timetable for removal of these ponds is indicted in Table 542.100a.

542.600. ROADS.

All roads not to be retained for an approved post-mining land use will be reclaimed after they are no longer needed for mining and reclamation operations. County Road 290 is a public road used to access Gentry Mountain and Carbon County's communication and relay facilities. In order to achieve post-mining land use, this road will be retained after final reclamation. Reclamation of mining areas adjacent to these roads will be performed in a manner which protects the long-term post-mining land uses of the roads and the area.

Roads will be reclaimed by pulling fill back up from the downslope and placing it in the cuts. The replaced fill material will be shaped to conform to the adjacent terrain and to meet natural drainage patterns. Following rough grading, topsoil will be applied to the regraded surfaces and the reclaimed roads will be mulched, deep gouged, and revegetated in accordance with Section 542.200 of this M&RP.

Natural drainages will be re-established across the reclaimed roads as indicated in Section 760. Culverts which are required for an approved post-mining land use (i.e., those which exist along County Road 290) will be retained; all others will be removed. Water bars and cross drains may be constructed across reclaimed roads to minimize erosion where necessary. The entrances to reclaimed roads will be blocked by barriers of native rock or earthen berms to prevent vehicular access.

As indicated in Exhibit 553.130b, a section of the lower portion of the Lion Deck access road experienced a stability failure in May 1994. Although this section of road was repaired, additional repair work is anticipated during reclamation to provide a long-term, stable surface for County Road 290. This repair

work will consist of the removal of approximately 12,600 cubic yards of material, backfilling this material in adjacent areas to assist in achieving the post-reclamation topography, and importing approximately 12,600 cubic yards of material from the alternate borrow area (identified in Section 233 of this M&RP) to reconstruct the road. The fill used to reconstruct the road will be placed with a thickness when compacted of no more than 8 inches. All fill placed during reconstruction of the road will be compacted to at least 92 percent of maximum Proctor density (ASTM D698). Compaction will be accomplished using repeated passes of rollers and other appropriate equipment.

542.700. FINAL ABANDONMENT OF MINE OPENINGS AND DISPOSAL AREAS.

Abandonment of Openings. All mine openings will be sealed at least 25 feet inside the mine opening. Prior to installation of the seal, all loose material will be removed from the roof, floor, and rib of the mine within 3 feet of the seal area. The seal will then be constructed using solid concrete blocks (average minimum compressive strength of 1,800 psi) with nominal dimensions of 6 inches high, 8 inches wide, and 16 inches long. Mortar will consist of one part cement, three parts sand, and no more than 7 gallons of water per sack of cement.

The seal will be recessed at least 16 inches deep into each rib and 12 inches deep into the floor. No recess will be made into the roof. In the bottom course, each block will be laid with its long axis parallel to the rib. The long axis in succeedingly higher courses will be perpendicular to the long axis of the blocks in the preceding course. An interlaced pilaster will be constructed in the center.

The seals will have a thickness of approximately 16 inches. Following seal construction, the entries will be backfilled from the seal to the outside surface with soil that is sloped at the surface to match the final slope at the entry. The soil will then be raked and revegetated with the approved seed mixture (see Section 300).

Alternatively, a cast-in-place MSHA approved seal will be installed with a minimum thickness of 3 feet and with a minimum compressive strength of 200 psi.

Disposal of Excess Spoil. If excess spoil is generated in the permit area, this material will be disposed of in the refuse pile prior to final reclamation of that pile. Material which is added to the refuse pile during reclamation will be placed in accordance with the procedures outlined in Section 528.322 of this M&RP.

Disposal of Coal Mine Waste. All reference to the refuse pile mentioned within this section is superseded with the information provded by Sunnyside Cogeneration Associates' Permit C/007/042. All coal mine waste generated at the Star Point Mines during reclamation will be disposed of at the refuse pile in accordance with the procedures outlined in Section 528.322 of this M&RP. The refuse pile will be reclaimed following completion of mining, placement of spoil and coal-mine waste generated during reclamation, and completion of the sampling program discussed in R645-301-528.322. During reclamation, the pile will be reshaped as necessary to achieve the approximate shape indicated on Map 542.200c, and then ripped or scarified to insure a stable contact between the refuse and the cover material. Subsequent to placement of the cover material, the surface will be gouged or pocked so as to produce a roughened surface to help control runoff and enhance local vegetative growth. Gouging or pocking of the surface material will be conducted in a manner so as to minimize penetration of the refuse material.

Test plots were established in 1982 on the east end of the refuse pile to evaluate various topsoil and subsoil depths for final reclamation of the refuse pile. To date, data indicate that as little as 10 inches of soil or subsoil will be adequate for final reclamation. However, since the data obtained from the test plots

(see Exhibit 553.130a). Furthermore, the refuse pile has been designed and constructed to be stable (see Exhibit 528.322a). The slopes have thus been designed to prevent slides.

Erosion and Water Pollution. Temporary sediment-control measures will be implemented during and following backfilling and regrading as outlined in Section 542.200 of this M&RP. As vegetation becomes established on the reclaimed surfaces, erosion potentials will be further minimized. By minimizing erosion, water pollution will also be precluded.

In an effort to eliminate pre-existing highwalls at the site following reclamation, the reclamation plan has been designed with soil being replaced at slopes of up to 2H:1V. As noted in Exhibits 528.322a and 553.130a, these slopes will be geotechnically stable. Dozers will be used during placement of the topsoil or substitute topsoil on these slopes, taking care to achieve a reasonably uniform thickness of the final soil cover. Following placement and prior to seeding, all areas with a slope steepness of 3H:1V or steeper will be deep gouged using a trackhoe. The final surface will consist of mounds and depressions capable of holding runoff and difficult to walk on.

Although the gouging will extend below the depth of the final topsoil layer, information presented in Section 222.400 of this M&RP indicates that the subsoils will be of acceptable chemical and physical quality, with the possible exception of the percentage of rock fragments. Hence, the surface will still be capable of sustaining an adequate vegetative cover, further minimizing long-term erosion of the slopes.

Post-Mining Land Use. The disturbed area will be backfilled and regraded in a manner that supports the approved post-mining land use in Section 412 and 413 of the M&RP.

553.200. SPOIL AND WASTE.

Spoil. All spoil generated within the permit area during reclamation will be placed on the refuse pile prior to its final reclamation. This material will be compacted during placement as outlined in Section 528.322 of this M&RP.

Refuse Piles. All reference to the refuse pile mentioned within this section is superseded with the information provided by Sunnyside Cogeneration Associates' Permit C/007/042. During reclamation, the refuse pile will be graded to achieve the approximate shape indicated on Map 542.200c. As indicated in Exhibit 528.322d, terraces will be constructed on the outslope of the refuse pile to control erosion and conserve soil moisture. The grade of the outslope between terrace benches has been designed to be 3H:1V. Following final grading of the refuse pile, the coal mine waste will be covered with a minimum of 4 feet of non-toxic, non-combustible material, or such other depth as deemed acceptable by the Division based on a review of the refuse-pile test-plot data or other appropriate research or studies.

Coal Processing Waste. Coal processing waste at the site will be disposed of primarily on the refuse pile prior to final reclamation of that pile. Coal processing waste that is not disposed of on the refuse pile will be covered with at least 4 feet of non-toxic, non-combustible material.

553.300. EXPOSED COAL SEAMS, ACID- AND TOXIC-FORMING MATERIALS, AND COMBUSTIBLE MATERIALS.

Exposed Coal Seams. Coal seams that were exposed during mining will be covered with a minimum of 4 feet of non-toxic and non-combustible materials during final backfilling and grading. This cover may consist of material removed during grading of the site (see Section 542.200), subsoil, and/or topsoil.

Prime Reference

Map 761a, As- Built Reclamation Watersheds and Diversions . . . . . Page 700- 187
Map 761b, As-Built Reclamation Watersheds and Diversions . . . . . Page 700- 187
Map 761c, As-Built Reclamation Watersheds and Diversions . . . . . Page 700- 187
Map 761d, As-Built Reclamation Channel Cross-Sections . . . . . Page 700- 187

LIST OF EXHIBITS

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Exhibit 722.100b, USGS Stream Data . . . . . Page 700- 32
Exhibit 724.100a, Water Quality Data Summary . . . . . Page 700- 38
Exhibit 724.200a, Field and Laboratory Methods for the Analysis of Water Quality Samples . . . . . Page 700- 48
Exhibit 728a, Spring Flow Hydrographs . . . . . Page 700- 55
Exhibit 728b, In-mine Well Completion Details, and Approval and Condition for Abandonment of Gentry Ridge Wells . . . . . Page 700- 60
Exhibit 728c, Aquifer Evaluations . . . . . Page 700- 67
Exhibit 728d, Special Water Quality Analyses . . . . . Page 700- 72
Exhibit 728e, Dispersion Calculations . . . . . Page 700- 84
Exhibit 728f, Spring and Ground Water Comparisons . . . . . Page 700- 89
Exhibit 728g, Hydrologic Reports Pertaining to the Abandonment of Equipment Underground . . . . . Page 700- 82
Exhibit 728h, Evaluation of Hydrologic Monitoring at the Star Point Mine . . . . . Page 700- 107
Exhibit 731.110a, Hydrologic Response to Land Subsidence Cause by Underground Coal Mining, Miller Creek Drainage, Carbon County, Utah . . . . . Page 700- 96
Exhibit 731.122a, Water Rights Mitigation Plan . . . . . Page 700- 100
Exhibit 732.300a, Diversion Ditch and Culvert Peak Flow Calculations . . . . . Page 700- 122
Exhibit 732.300b, Hydrologic Calculation Update . . . . . Page 700- 122
Exhibit 732.300c, Unit Train Hydrology . . . . . Page 700- 122
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Exhibit 742.312a, Riprap Calculations	Page 700- 172
Exhibit 761a, Ditch and Channel Design Calculations	Page 700- 187
Exhibit 761b, River Gas Road Culvert and Ditch Designs	Page 700- 188
Exhibit 761c, As-Built Hydrology Calculations and Construction	Page 700- 187

Channel Reclamation - General. All sedimentation ponds and Treatment Facility No. 1 located in conjunction with the Star Point operation are temporary in nature and have been designed according to applicable regulations. These facilities will be removed or filled upon completion of the coal mining operation. As required by Federal and State regulations, such areas disturbed by temporary pond and channel diversion construction will be restored to match surrounding conditions, and the area will be stabilized with an effective vegetative cover as soon as possible after removal. This cover will be composed of native and other plants which are adaptable to the site and provide soil stability.

Stream channel reclamation design has been undertaken as required in the mining regulations. Upon reclamation, existing roadways (except those discussed in Section 542.600) and the existing surface-water conveyance facilities will be removed and the area regraded to the extent technically practical to pre-mining conditions, including revegetation of disturbed areas as specified in the reclamation plan. The plan includes the removal of most of the culverts and temporary diversion facilities associated with mining activities and the restoration of surface contours. A s-built conditions ~~plan~~ showing the culverts and channels ~~to be retained or~~ constructed upon reclamation of the site ~~is~~ are presented on Maps 761a through 761 d e. Culverts to be retained are associated with the roads that will be retained consistent with the post-mining land use.

It should be noted that the extent of the channels and culverts shown on Maps 761a through 761c are for illustrative purposes. The actual extent will be determined in the field, ensuring that channels are constructed across all reclaimed cut and fill slopes and that culverts extend beneath the retained county road. In the area of the Lion Deck, all channels on the uphill side of the county road will cross the reclaimed fill prior to discharging into the reclamation culverts. It is anticipated that the reclamation culverts will extend primarily beneath the road surface. Final extent of reclamation channels and culverts will be determined in the field.

Reclamation Channel Design. Reclamation channel designs were based on the assumption that existing surface disturbances such as roadways (except as described in Section 542.600) and diversions (except those associated with the retained road) will be removed upon final reclamation and that surface runoff will follow natural flow paths approximating those which existed prior to mining. With flow paths defined, anticipated peak surface runoff rates were calculated using the curve-number methodology of the U.S. Soil Conservation Service (1972). Upstream and downstream cross-sections were observed in the field for those channels requiring reclamation and channel design has been completed to match natural conditions to the extent possible.

Reclaimed channel design calculations for the mine permit area are shown in Exhibit 761a. Diversions with a drainage area of less than 1 square mile were designed to safely convey the peak flow resulting from the 10-year, 6-hour precipitation event (in accordance with R645-301-742.333). The "main" reclamation channel (SPRD-31), with a drainage area of greater than 1 square mile, is classified as intermittent due to its watershed size (R645-100-200) and was, therefore, designed to convey the peak flow resulting from the 100-year, 6-hour precipitation event. Watershed boundaries for the drainage areas associated with each reclamation diversion are indicated on Maps 761a through 761c or in Exhibit 761a if those watershed boundaries extend beyond the borders of the maps.

Exhibit 761a presents designs and Exhibit 761c presents the as-built construction for the following three categories of reclamation channels:

- Standard broad-swale design
- Standard riprap-channel design

- Site-specific channel design

Channels which fit into each of the above categories are identified in Exhibit 761a and Exhibit 761c. The standard broad-swale design will generally be installed high in the watershed on steep reclaimed slopes where drainage areas and design discharges are limited. This channel will consist of a broad swale in which an erosion-control mat has been installed (Tensar TM-3000 or equivalent) and then seeded with the appropriate seed mix. The mat will provide immediate erosion protection, which will ultimately be enhanced by the vegetation.

The standard riprap-channel design will generally be installed lower in the watersheds where design discharges are greater. The standard design consists of riprap with a median diameter of 6 inches installed over a sand filter blanket, with a bottom width of 4 feet, a depth of 1 foot, and side slopes of 2H:1V. The filter blanket will consist of the standard Utah Department of Transportation ("UDOT") 1-inch mix.

Site-specific channel designs are generally in lower reaches of the watersheds where design flows are higher. These channels have been designed with riprap underlain by one or two filter blankets (depending upon the median diameter of the riprap), or with erosion-control mat, depending on the location. Where on filter blanket is designed, it will consist of the UDOT 1-inch mix. Where two filter blankets are designed, they will consist of a d_{50} = 1-inch material overlying the UDOT 1-inch mix. Channel dimensions and median riprap diameters vary between the site-specific designs.

Tables 761a and 761b summarizes the design of the reclamation channels. Location~~s~~ and as-built cross-section of the~~se~~ channels constructed during reclamation are ~~noted~~ shown on Maps 761a through 761d~~-e~~ and the as-built calculations demonstrating compliance with the design parameters are presented in Exhibit 761c. Note ~~on Map 761c that~~ Channels SPRD-32, -34, -39, -41, -42, -43 and a segment of SPRD-40 are associated with Sunnyside Cogeneration Associates' Permit C/007/042 and no longer permitted by PMC under C/007/006 or shown on Map 761c.

~~Note on~~ Maps 761a and 761c ~~that~~ show portions of ~~five~~ four reclamation channels (SPRD-25a, -25b, -26, ~~-27~~, ~~-28,~~ and -26a ~~-38~~) ~~will be~~ constructed across the old (pre-SMCRA) tram grade that will not be reclaimed under this plan (compare with Maps 542.200a and 542.200c). Runoff from above this abandoned grade has on occasion flowed down this grade in the past, causing localized erosion of the grade and diversion of flows into facility areas. In order to prevent this from occurring following reclamation, the channels will be extended across the grade at the indicated locations. Each of these channels will consist of the standard broad-swale design (just as the lower portions are designed) and will be constructed as noted above. The only regrading of the tram area will occur where the channels cross the grade, with no additional reclamation of the tram grade being anticipated. The reclamation design for the Lion's Deck and Pond 001 areas have been refined necessitating a new channel design. The modified channel design for these areas can be found in an Addendum to Exhibit 761a.

Reclamation Culvert Design. Several existing culverts associated with County Road 290 will be retained following reclamation. The retention of these culverts is necessary for long-term maintenance of the condition of the road.

Operational culvert 46B will be replaced by SPRC-44 to allow reclamation of the access road to Pond 001. Details of the design can be found in the Addendum to Exhibit 761a.

762. ROAD RECLAMATION.

All roads located on the permit property not to be retained for an approved post-mining land use will be reclaimed immediately after they are no longer needed for coal mining and reclamation operations.

Design calculations for culverts and ditches associated with the River Gas road are presented in Exhibit 761b. Since this road will not be reclaimed, these structures will be retained following reclamation. Sediment contributions from the road will be minimized by proper road maintenance and by surfacing the road with gravel road-base material.

Exhibit 117.200a

Public Notice

Application for Phase I Bond Release
Star Point Mine
Plateau Mining Corporation
Permit C/007/006, Approved 01/28/92

Notice is hereby given that Plateau Mining Corporation, P.O. Box 30, 847 Northwest Highway 191, Helper, Utah 84526, a subsidiary of RAG American Coal Company, 999 Corporate Blvd., Linthicum Heights, MD 21090, has filed an application with the Utah Department of Natural Resources, Division of Oil, Gas and Mining pursuant to R645-301-880 for Phase I bond release to Permit C/007/006. The Phase I bond release applies to 95.3 acres, including the Corner Canyon and Mudwater Fan sites, of disturbed lands where the backfilling and grading, installation of drainage controls, and reseeding requirements have been completed in accordance with approved mining and reclamation plan and pursuant to the Utah Coal Program Regulations.

In accordance with the provision of R645-301-880, of the State of Utah R645 Coal Mining Rules, notice is hereby given that Plateau Mining Corporation is applying for partial release of the performance bond posted for this property. The surety bond posted for the Star Point Mine is $7,643,000.00. Plateau Mining Corporation is seeking release of 60% of the bond, or $4,585,800.00.

The portion of the permit area that is affected is located in Carbon County, Utah as follows:

Township 15 South, Range 7 East, SLB&M

Section 12: Portion of the NE1/4NW1/4

Township 15 South, Range 8 East, SLB&M

Section 8: Portion of the SW1/4NW1/4
Section 9: Portion of the SE1/4SE1/4; SW1/4SW1/4
Section 10: Portion of the S1/2 North of County Road 290
Section 15: Portion of the NE1/4NE1/4
Section 16: Portion of the N1/2; SE1/4

The permit area is shown on the Wattis U.S. Geological Survey 7.5-minute map.

The Utah Division of Oil, Gas and Mining will now evaluate the proposal to determine whether it meets all the criteria of the Permanent Program Performance Standards according to the requirements of the Utah Coal Mining Rules.

Written comments, objections and requests for information conferences on this proposal may be addressed to:

Utah Coal Program
Utah Division of Oil, Gas and Mining
1594 West North Temple, Suite 1210
P.O. Box 145801
Salt Lake City, Utah 84114-5801

Closing date for submission of such comments, objections and requests for public hearing or information conference on the proposal must be submitted by Month, Date, and Year.

Published in the Sun Advocate Month Date, Date, Date and Date

Exhibit 412.200a

Month Date, Year

Mr. William D. Krompel
Commissioner
120 East Main Street
Price, Utah 84501

Re: <u>Notification of Application for Phase I Bond Release, Star Point Mine, Plateau Mining Corporation, C/007/006, Carbon County, Utah</u>

Dear Mr. Krompel:

Plateau Mining Corporation has completed Phase I of the approved reclamation plan for the Star Point Mine area. This is based on completing the backfilling and grading, installation of drainage controls, and reseeding requirements on 93.5 acres in accordance with the approved reclamation plan.

Pursuant to the provisions of R645-301-880 of the State of Utah R645 Coal Mining Rules, this letter will serve as notification that Plateau Mining Corporation intends to file an application with the Utah Division of Oil, Gas and Mining for partial release of the performance bond posted for this operation.

The surety bond posted for the Star Point Mine is $7,643,000.00. Plateau Mining Corporation is seeking release of 60% of the bond, or $4,585,800.00.

Comments concerning Phase I bond release from the legal or equitable owner of record of the surface areas affected and from the Federal, Utah and local government agencies should be mailed to: Plateau Mining Corporation, Attention: Johnny Pappas, 847 NW Highway 191, Helper, Utah 84526.

A copy of the public notice is attached. If you have any questions or need additional information, please do not hesitate to contact me at (435) 472-4741.

Sincerely,

Johnny Pappas
Sr. Environmental Engineer

Attachment

Env: Star Point Mine-Phase I Bond Release
Chrono: JP031001.LTR

Month Date, Year

Ms. Alice B. Carlton
Forest Supervisor
599 West Price River Drive
Price, Utah 84501

Re: <u>Notification of Application for Phase I Bond Release, Star Point Mine, Plateau Mining Corporation, C/007/006, Carbon County, Utah</u>

Dear Ms. Carlton:

Plateau Mining Corporation has completed Phase I of the approved reclamation plan for the Star Point Mine area. This is based on completing the backfilling and grading, installation of drainage controls, and reseeding requirements on 93.5 acres in accordance with the approved reclamation plan.

Pursuant to the provisions of R645-301-880 of the State of Utah R645 Coal Mining Rules, this letter will serve as notification that Plateau Mining Corporation intends to file an application with the Utah Division of Oil, Gas and Mining for partial release of the performance bond posted for this operation.

The surety bond posted for the Star Point Mine is $7,643,000.00. Plateau Mining Corporation is seeking release of 60% of the bond, or $4,585,800.00.

Comments concerning Phase I bond release from the legal or equitable owner of record of the surface areas affected and from the Federal, Utah and local government agencies should be mailed to: Plateau Mining Corporation, Attention: Johnny Pappas, 847 NW Highway 191, Helper, Utah 84526.

A copy of the public notice is attached. If you have any questions or need additional information, please do not hesitate to contact me at (435) 472-4741.

Sincerely,

Johnny Pappas
Sr. Environmental Engineer

Attachment

Env: Star Point Mine-Phase I Bond Release
Chrono: JP031001.LTR

Month Date, Year

Mr. Mark Mackiewicz
Bureau of Land Management
125 South 600 West
Price, Utah 84501

Re: <u>Notification of Application for Phase I Bond Release, Star Point Mine, Plateau Mining Corporation, C/007/006, Carbon County, Utah</u>

Dear Mr. Mackiewicz:

Plateau Mining Corporation has completed Phase I of the approved reclamation plan for the Star Point Mine area. This is based on completing the backfilling and grading, installation of drainage controls, and reseeding requirements on 95.3 acres in accordance with the approved reclamation plan.

Pursuant to the provisions of R645-301-880 of the State of Utah R645 Coal Mining Rules, this letter will serve as notification that Plateau Mining Corporation intends to file an application with the Utah Division of Oil, Gas and Mining for partial release of the performance bond posted for this operation.

The surety bond posted for the Star Point Mine is $7,643,000.00. Plateau Mining Corporation is seeking release of 60% of the bond, or $4,585,800.00.

Comments concerning Phase I bond release from the legal or equitable owner of record of the surface areas affected and from the Federal, Utah and local government agencies should be mailed to: Plateau Mining Corporation, Attention: Johnny Pappas, 847 NW Highway 191, Helper, Utah 84526.

A copy of the public notice is attached. If you have any questions or need additional information, please do not hesitate to contact me at (435) 472-4741.

Sincerely,

Johnny Pappas
Sr. Environmental Engineer

Attachment

Env: Star Point Mine-Phase I Bond Release
Chrono: JP031001.LTR

Month Date, Year

Mr. Randy Scott
General Manager
Sunnyside Cogeneration Associates
#1 Power Plant Road
Sunnyside, Utah 84539

Re: <u>Notification of Application for Phase I Bond Release, Star Point Mine, Plateau Mining Corporation, C/007/006, Carbon County, Utah</u>

Dear Mr. Scott:

Plateau Mining Corporation has completed Phase I of the approved reclamation plan for the Star Point Mine area. This is based on completing the backfilling and grading, installation of drainage controls, and reseeding requirements on 93.5 acres in accordance with the approved reclamation plan.

Pursuant to the provisions of R645-301-880 of the State of Utah R645 Coal Mining Rules, this letter will serve as notification that Plateau Mining Corporation intends to file an application with the Utah Division of Oil, Gas and Mining for partial release of the performance bond posted for this operation.

The surety bond posted for the Star Point Mine is $7,643,000.00. Plateau Mining Corporation is seeking release of 60% of the bond, or $4,585,800.00.

Comments concerning Phase I bond release from the legal or equitable owner of record of the surface areas affected and from the Federal, Utah and local government agencies should be mailed to: Plateau Mining Corporation, Attention: Johnny Pappas, 847 NW Highway 191, Helper, Utah 84526.

A copy of the public notice is attached. If you have any questions or need additional information, please do not hesitate to contact me at (435) 472-4741.

Sincerely,

Johnny Pappas
Sr. Environmental Engineer

Attachment

Env: Star Point Mine-Phase I Bond Release
Chrono: JP031001.LTR

Month Date, Year

Mr. Kevin S. Carter
Director
School and Institutional Trust Lands Administration
675 East 500 South, Suite 500
Salt Lake City, Utah 84102-2818

Re: Notification of Application for Phase I Bond Release, Star Point Mine, Plateau Mining Corporation, C/007/006, Carbon County, Utah

Dear Mr. Carter:

Plateau Mining Corporation has completed Phase I of the approved reclamation plan for the Star Point Mine area. This is based on completing the backfilling and grading, installation of drainage controls, and reseeding requirements on 93.5 acres in accordance with the approved reclamation plan.

Pursuant to the provisions of R645-301-880 of the State of Utah R645 Coal Mining Rules, this letter will serve as notification that Plateau Mining Corporation intends to file an application with the Utah Division of Oil, Gas and Mining for partial release of the performance bond posted for this operation.

The surety bond posted for the Star Point Mine is $7,643,000.00. Plateau Mining Corporation is seeking release of 60% of the bond, or $4,585,800.00.

Comments concerning Phase I bond release from the legal or equitable owner of record of the surface areas affected and from the Federal, Utah and local government agencies should be mailed to: Plateau Mining Corporation, Attention: Johnny Pappas, 847 NW Highway 191, Helper, Utah 84526.

A copy of the public notice is attached. If you have any questions or need additional information, please do not hesitate to contact me at (435) 472-4741.

Sincerely,

Johnny Pappas
Sr. Environmental Engineer

Attachment

Env: Star Point Mine-Phase I Bond Release
Chrono: JP031001.LTR

Exhibit 761c

As-built Hydrology Calculations

The purpose of these calculations is to demonstrate that the constructed reclamation channels can handle the peak flow generated by the 10-yr 6-hr Design storm event. All channels have been verified assuming a 10-yr 6-hr storm event except the main channel (SPRD-31) which has been designed for the 100-yr 6-hr storm event.

To minimize confusion and ease review watersheds and channels have been labeled in the same manner as found in the design calculations in Exhibit 761a and the Addendum to Exhibit 761a. Any deviation from this has been identified in the following tables and calculations.

Where watershed areas changed very little or the as-built channel configuration resulted in a smaller watershed area, draining to the channel, the peak flows determined in Exhibit 761a and the Addendum to Exhibit 761a were used. If the as-built watershed was larger than the design watershed the peak flow was recalculated. In many cases the design watershed was larger than the as-built watershed and the larger design peak flow was used to be conservative. For example the as-built watershed RWS-31 is much smaller than the design watershed since SCA took control of the refuse pile. However, the design peak flow from Exhibit 761a has been used to be conservative

The Curve Number summary on pages 2 to 4 identifies the watersheds that have been recalculated.

Data for all of the watersheds have been summarized in the adjoining tables. (See pages 5 and 6)

The same methodology described on pages 1 & 4 of Exhibit 761a have been used for these calculations.

Watershed locations can be seen on Maps 761a, 761b, and 761c

REGISTERED PROFESSIONAL ENGINEER
10-28-03
No. 189797
LAYNE D. JENSEN
STATE OF UTAH

STAR POINT MINE AS-BUILT RECLAMATION
CURVE NUMBER SUMMARY

	Watershed No.	Total Area (ac)	Undisturbed		Reclaimed		Weighted CN
			Area (ac)	CN	Area (ac)	CN	
*	RWS-1	9.1	7.7	75	1.4	80	76
*	RWS-2	4.4	4.0	65	0.4	80	66
*	RWS-3	2.7	2.5	65	0.2	80	66
*	RWS-4	8.8	8.3	65	0.5	80	66
*	RWS-5	2.6	2.2	65	0.4	80	67
*	RWS-6	7.1	6.5	65	0.6	80	66
*	RWS-7	11.4	11.2	70	0.2	80	70
	RWS-8	13.87	12.95	70	0.92	85	71
	RWS-9	2.36	2.15	68	0.21	80	69
	RWS-10	6.23	2.89	67	3.34	80	74
	RWS-11	1.96	1.32	67	0.64	80	71
	RWS-12	14.86	10.65	70	4.21	80	73
*	RWS-14	7.7	6.3	75	1.4	80	76
	RWS-15	5.51	5.26	75	0.25	90	76
*	RWS-16	7.5	6.2	75	1.3	80	76
*	RWS-21	14.0	9.3	75	4.7	81	77
*	RWS-22	29.0	23.7	70	5.3	81	72
*	RWS-24	191.3	155.8	70	35.5	81	72
	RWS-25a	3.74	3.64	80	0.1	80	80
	RWS-25b	4.80	4.70	80	0.1	80	80
*	RWS-26	10.2	10.1	80	0.1	80	80
	RWS-27	0.41	0.40	80	0.01	80	80

- RWS-13 Not used due to channel configuration change in the field.
- RWS-17-20 and RWS-23 Replaced in the Addendum to Exhibit 76la by RWS-44-53

* Information copied from Exhibit 761a

STAR POINT MINE AS-BUILT RECLAMATION
CURVE NUMBER SUMMARY (cont.)

	Watershed No.	Total Area (ac)	Undisturbed		Reclaimed		Weighted CN
			Area (ac)	CN	Area (ac)	CN	
	RWS-28	8.65	8.40	80	0.25	80	80
	RWS-29a	19.34	16.74	80	2.60	96	82
	RWS-29b	13.62	13.17	80	0.45	80	80
*	RWS-30	9.1	8.6	80	0.5	80	80
*	RWS-31	772.3	652.6	75	119.7	81	76
*	RWS-33	14.6	11.7	80	2.9	83	81
	RWS-35	19.35	18.66	90	0.69	80	90
	RWS-35a	1.02	0.83	90	0.19	80	88
*	RWS-36	3.1	2.6	90	0.5	80	88
	RWS-40	2.86	2.42	90	0.44	80	88
*	RWS-44	24.24	24.02	65	0.22	80	66
*	RWS-45	9.65	7.47	70	2.18	80	73
*	RWS-46	20.67	18.20	65	2.47	82	67
*	RWS-47	15.00	13.58	65	1.42	82	67
*	RWS-48	11.40	9.40	65	2.00	83	69
*	RWS-49	10.76	9.50	65	1.26	83	68
*	RWS-50	23.78	22.68	70	1.10	82	71
*	RWS-51	10.72	7.59	70	3.13	84	74
	RWS-52	1.71	0.45	80	1.26	80	80
	RWS-53	4.27	2.12	80	2.15	80	80

- RWS-32, 34, 39, 41, 42 and 43 Are now all part of the SCA permit area
- RWS-37 and 38 Were not needed since channels were not constructed in these areas

* Information copied from Exhibit 76la and the Addendum to Exhibit 76la.

STAR POINT MINE AS-BUILT RECLAMATION
CURVE NUMBER SUMMARY (cont.)

	Watershed No.	Total Area (ac)	Undisturbed		Reclaimed		Weighted CN
			Area (ac)	CN	Area (ac)	CN	
+	RWS-54	4.59	4.49	80	0.1	80	80
+	RWS-55	5.65	5.55	80	0.1	80	80
+	RWS-56	0.65	0.55	80	0.1	80	80
+	RWS-57	2.30	2.10	80	0.2	80	80

+ These watersheds are associated with 4 new channels that were not included in the reclamation design.

Watershed Area a	Drainage Area (ac)	Curve Number	S (in)	Y (%)	l (ft)	L (hr)	Time of Conc. (hr)	Peak Flow (cfs)
RWS-1	9.1	76	3.158	68.6	1160	0.049	0.081	0.86
RWS-2	4.4	66	5.152	63.7	980	0.058	0.097	0.06
RWS-3	2.7	66	5.152	76.5	820	0.046	0.077	0.03
RWS-4	8.8	66	5.152	75.1	1020	0.055	0.092	0.11
RWS-5	2.6	67	4.925	79.5	980	0.051	0.085	0.04
RWS-6	7.1	66	5.152	80.8	1020	0.053	0.089	0.09
RWS-7	11.4	70	4.286	68.9	1100	0.055	0.092	0.25
RWS-8	13.87	71	4.085	63.6	1820	0.084	0.140	0.35
RWS-9	2.36	69	4.493	54.8	885	0.053	0.089	0.05
RWS-10	6.23	74	3.514	54.6	1305	0.064	0.106	0.28
RWS-11	1.96	71	4.085	62.8	842	0.045	0.076	0.05
RWS-12	14.86	73	3.699	62.1	1680	0.075	0.125	0.53
RWS-14	7.7	76	3.158	57.8	1180	0.054	0.090	0.7
RWS-15	5.51	76	3.158	65.9	1150	0.049	0.082	0.51
RWS-16	7.5	76	3.158	53.3	1020	0.050	0.083	0.71
RWS-21	14	77	2.987	6.6	2720	0.302	0.504	0.81
RWS-22	29	72	3.889	41.2	2560	0.133	0.222	0.85
RWS-24	191.3	72	3.889	46.5	5040	0.215	0.359	5.35
RWS-25a	3.74	80	2.500	67.9	940	0.037	0.061	0.78
RWS-25b	4.8	80	2.500	65.7	985	0.039	0.065	0.99
RWS-26	10.2	80	2.500	57.6	1280	0.051	0.085	1.99
RWS-27	0.41	80	2.500	55.7	240	0.014	0.023	0.09
RWS-28	8.65	80	2.500	52	1670	0.066	0.111	1.62
RWS-29a	19.34	82	2.195	55.1	3960	0.121	0.202	4.72
RWS-29b	13.62	80	2.500	60.6	1855	0.067	0.112	2.54

Watershed Area a	Drainage Area (ac)	Curve Number	S (in)	Y (%)	l (ft)	L (hr)	Time of Conc. (hr)	Peak Flow (cfs)
RWS-30	9	80	2.500	48.4	1680	0.069	0.116	1.67
RWS-31	772.3	76	3.158	55.4	10500	0.316	0.528	145.73
RWS-33	14.6	81	2.346	21.5	2400	0.134	0.223	2.6
RWS-35	19.35	90	1.111	75.1	1870	0.042	0.071	7.8
RWS-35a	1.02	88	1.364	46.6	625	0.024	0.041	0.52
RWS-36	3.1	88	1.364	59.2	800	0.026	0.044	1.57
RWS-40	2.86	88	1.364	56.6	925	0.030	0.050	1.44
RWS-44	24.24	66	5.152	67	2200	0.108	0.181	0.3
RWS-45	9.65	73	3.699	49.5	600	0.037	0.062	0.35
RWS-46	20.67	67	4.925	75.5	1800	0.085	0.141	0.3
RWS-47	15	67	4.925	67.4	1700	0.086	0.143	0.22
RWS-48	11.4	69	4.493	80.5	1600	0.071	0.118	0.22
RWS-49	10.76	68	4.706	75.1	1540	0.073	0.122	0.18
RWS-50	23.76	71	4.085	64.5	2000	0.089	0.149	0.61
RWS-51	10.72	74	3.514	59.1	720	0.038	0.063	0.58
RWS-52	1.71	80	2.500	68.9	505	0.022	0.037	0.37
RWS-53	4.27	80	2.500	56.8	575	0.027	0.045	0.92
RWS-54	4.59	80	2.500	54.5	1480	0.059	0.098	0.88
RWS-55	5.65	80	2.500	47.7	1470	0.063	0.105	1.07
RWS-56	0.65	80	2.500	48.4	610	0.031	0.051	0.14
RWS-57	2.3	80	2.500	44	1210	0.056	0.093	0.45

Notes

S = 1000/CN - 10

Y = average watershed slope = (length of contour lines)(contour interval)/(watershed area)

l = hydraulic length

L = watershed lag =(l^0.8(S+1)^0.7) / (1900(Y)^0.5)

Time of Concentration + 1.67L

Peak Flow is based on a 10-yr 6-hr storm event except for RWS-31 which is a 100-yr 6-hr storm event

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
RWS-8

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 13.87 acres
Depth = 1.40 inches	CN = 71.00
Duration = 6.0 hrs	Time conc.= 0.14 hrs

OUTPUT SUMMARY

Runoff depth: 0.073 inches
Initial abstr: 0.817 inches
Peak flow: 0.35 cfs (0.025 iph)
at time: 3.528 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
RWS-9

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 2.36 acres
Depth = 1.40 inches	CN = 69.00
Duration = 6.0 hrs	Time conc.= 0.09 hrs

OUTPUT SUMMARY

Runoff depth: 0.050 inches
Initial abstr: 0.899 inches
Peak flow: 0.05 cfs (0.019 iph)
at time: 5.518 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
RWS-10

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 6.23 acres
Depth = 1.40 inches	CN = 74.00
Duration = 6.0 hrs	Time conc.= 0.11 hrs

OUTPUT SUMMARY

Runoff depth: 0.115 inches
Initial abstr: 0.703 inches
Peak flow: 0.28 cfs (0.044 iph)
at time: 2.558 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
RWS-11

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 1.96 acres
Depth = 1.40 inches	CN = 71.00
Duration = 6.0 hrs	Time conc.= 0.08 hrs

OUTPUT SUMMARY

Runoff depth: 0.073 inches
Initial abstr: 0.817 inches
Peak flow: 0.05 cfs (0.026 iph)
at time: 3.516 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
RWS-12

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 14.86 acres
Depth = 1.40 inches	CN = 73.00
Duration = 6.0 hrs	Time conc.= 0.13 hrs

OUTPUT SUMMARY

Runoff depth: 0.100 inches
Initial abstr: 0.740 inches
Peak flow: 0.53 cfs (0.035 iph)
at time: 3.517 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
RWS-15

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 5.51 acres
Depth = 1.40 inches	CN = 76.00
Duration = 6.0 hrs	Time conc.= 0.08 hrs

OUTPUT SUMMARY

Runoff depth: 0.150 inches
Initial abstr: 0.632 inches
Peak flow: 0.51 cfs (0.093 iph)
at time: 2.526 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
RWS-25a

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 3.74 acres
Depth = 1.40 inches	CN = 80.00
Duration = 6.0 hrs	Time conc.= 0.06 hrs

OUTPUT SUMMARY

Runoff depth: 0.238 inches
Initial abstr: 0.500 inches
Peak flow: 0.78 cfs (0.206 iph)
at time: 2.513 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
RWS-25b

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 4.80 acres
Depth = 1.40 inches	CN = 80.00
Duration = 6.0 hrs	Time conc.= 0.07 hrs

OUTPUT SUMMARY

Runoff depth: 0.238 inches
Initial abstr: 0.500 inches
Peak flow: 0.99 cfs (0.204 iph)
at time: 2.513 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
RWS-27

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 0.41 acres
Depth = 1.40 inches	CN = 80.00
Duration = 6.0 hrs	Time conc.= 0.02 hrs

OUTPUT SUMMARY

Runoff depth: 0.238 inches
Initial abstr: 0.500 inches
Peak flow: 0.09 cfs (0.223 iph)
at time: 2.502 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
RWS-28

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 8.65 acres
Depth = 1.40 inches	CN = 80.00
Duration = 6.0 hrs	Time conc.= 0.11 hrs

OUTPUT SUMMARY

Runoff depth: 0.238 inches
Initial abstr: 0.500 inches
Peak flow: 1.62 cfs (0.186 iph)
at time: 2.531 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
RWS-29a

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 19.34 acres
Depth = 1.40 inches	CN = 82.00
Duration = 6.0 hrs	Time conc.= 0.12 hrs

OUTPUT SUMMARY

Runoff depth: 0.293 inches
Initial abstr: 0.439 inches
Peak flow: 4.72 cfs (0.242 iph)
at time: 2.533 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
RWS-29b

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 13.62 acres
Depth = 1.40 inches	CN = 80.00
Duration = 6.0 hrs	Time conc.= 0.11 hrs

OUTPUT SUMMARY

Runoff depth: 0.238 inches
Initial abstr: 0.500 inches
Peak flow: 2.54 cfs (0.185 iph)
at time: 2.539 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
RWS-35

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 13.35 acres
Depth = 1.40 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.07 hrs

OUTPUT SUMMARY

Runoff depth: 0.606 inches
Initial abstr: 0.222 inches
Peak flow: 7.80 cfs (0.580 iph)
at time: 2.509 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
RWS-35

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 1.02 acres
Depth = 1.40 inches	CN = 88.00
Duration = 6.0 hrs	Time conc.= 0.04 hrs

OUTPUT SUMMARY

Runoff depth: 0.510 inches
Initial abstr: 0.273 inches
Peak flow: 0.52 cfs (0.502 iph)
at time: 2.504 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
RWS-40

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 2.86 acres
Depth = 1.40 inches	CN = 88.00
Duration = 6.0 hrs	Time conc.= 0.05 hrs

OUTPUT SUMMARY

Runoff depth: 0.510 inches
Initial abstr: 0.273 inches
Peak flow: 1.44 cfs (0.499 iph)
at time: 2.507 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
RWS-52

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 1.71 acres
Depth = 1.40 inches	CN = 80.00
Duration = 6.0 hrs	Time conc.= 0.04 hrs

OUTPUT SUMMARY

Runoff depth: 0.238 inches
Initial abstr: 0.500 inches
Peak flow: 0.37 cfs (0.217 iph)
at time: 2.506 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
RWS-53

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 4.27 acres
Depth = 1.40 inches	CN = 80.00
Duration = 6.0 hrs	Time conc.= 0.05 hrs

OUTPUT SUMMARY

Runoff depth: 0.238 inches
Initial abstr: 0.500 inches
Peak flow: 0.92 cfs (0.213 iph)
at time: 2.508 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
RWS-54

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 4.59 acres
Depth = 1.40 inches	CN = 80.00
Duration = 6.0 hrs	Time conc.= 0.10 hrs

OUTPUT SUMMARY

Runoff depth: 0.238 inches
Initial abstr: 0.500 inches
Peak flow: 0.88 cfs (0.190 iph)
at time: 2.522 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
RWS-55

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 5.65 acres
Depth = 1.40 inches	CN = 80.00
Duration = 6.0 hrs	Time conc.= 0.11 hrs

OUTPUT SUMMARY

Runoff depth: 0.238 inches
Initial abstr: 0.500 inches
Peak flow: 1.07 cfs (0.188 iph)
at time: 2.534 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
RWS-56

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 0.65 acres
Depth = 1.40 inches	CN = 80.00
Duration = 6.0 hrs	Time conc.= 0.05 hrs

OUTPUT SUMMARY

Runoff depth: 0.238 inches
Initial abstr: 0.500 inches
Peak flow: 0.14 cfs (0.210 iph)
at time: 2.509 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
RWS-57

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 2.30 acres
Depth = 1.40 inches	CN = 80.00
Duration = 6.0 hrs	Time conc.= 0.09 hrs

OUTPUT SUMMARY

Runoff depth: 0.238 inches
Initial abstr: 0.500 inches
Peak flow: 0.45 cfs (0.192 iph)
at time: 2.530 hrs

Channel Verification

The purpose of this section is to verify that the as-built channels can handle the 10-yr 6-hr storm event. Channels were modified during construction as a result of field conditions. These calculations demonstrate that the channels are still adequate

To facilitate construction a standard channel using pyramat (an erosion control mat) was specified for most channels. Since a standard design was used for construction of most channels a single calculation assuming the minimum cross-section for this standard channel will verify the adequacy of the standard channel. Riprap channels or non-standard pyramat channels will be verified individually.

A summary of the channels as measured in August 2003 can be found in the table on pages 34 through 38

The same methodology and assumptions used in the design in Exhibit 76la and the Addendum to Exhibit 76la have been used for these calculations.

Channel profiles can be found on attached figures 1 through 39 with the profile for main channel SPRD-31 on Map 542.200F

Channel cross-sections can be found on Map 761d

Standard Pyramat channel verification.

The original design specified Tensar TM-3000 Erosion Control Mat. At the time of construction this mat was no longer available. SI Industries Pyramat was substituted. The Pyramat has the same or better performance as the Tensar TM-3000. See the end of this section for detailed information on pyramat.

The minimum cross-section (minimum capacity) measured in the field is:

Bottom width	=	2.0'	(SPRD-17b, 19b + 25a)
Average Side slopes	=	1.03:1	(SPRD-17c)
Depth	=	0.67'	(SPRD-17c)
max slope	=	68.0%	(SPRD-17c)
min. slope	=	7.9%	(SPRD-5)
Peak flow	=	1.7 cfs.	

These measurements represent a worst case. The majority of Pyramat channel has a bottom width of 2.5-3', side slopes flatter than 1.75:1 and depth over 0.8'. Thus actual capacity will be much greater than this calculation demonstrates.

These worst case calculations assume a non-vegetated state ($n=0.025$) and maximum slope for checking velocity and a well vegetated ($n=0.047$) and minimum slope for checking adequate depth.

Calculation sheets can be found on pages 39 and 40

The following Pyramat channels are within the above criteria:

SPRD-1	SPRD-14	SPRD-20a	SPRD-44
SPRD-1a	SPRD-14a	SPRD-21	SPRD-45
SPRD-2	SPRD-15	SPRD-25a	SPRD-46
SPRD-3	SPRD-16	SPRD-25b	SPRD-47
SPRD-4a	SPRD-17a	SPRD-26	SPRD-48
SPRD-4b	SPRD-17b	SPRD-27	SPRD-49
SPRD-5	SPRD-17c *	SPRD-28	
SPRD-6	SPRD-18a	SPRD-30	
SPRD-7	SPRD-18b	SPRD-35a	
SPRD-9	SPRD-19a	SPRD-36a	
SPRD-11	SPRD-19b	SPRD-40	

The following Pyramat channels will be verified independently:

SPRD-10, SPRD-20b, SPRD-29b, and SPRD-35

Calculation sheets for these channels can be found on pages 41 through 48

* It would have been preferable to have a riprap channel for SPRD-17c. However, the slope was so steep that a riprap channel would have been unstable. The slope exceeded the angle of repose for the filter material and likely exceeded the angle of repose for the riprap.

All Riprap channels will be verified individually.

The Mannings n will be determined using the following equation, which takes into account the slope and riprap size:

$$n = 0.0456\,(D_{50} \times Slope)^{0.159}$$

D_{50} = Riprap median diameter (in)
Slope = Slope (ft/ft)

Abt, S.R., Khattak, M.S., Nelson, J.D., Ruff, J.E., Shaikh, A., Wittler, R.J., Lee, D.W. and Hinkle, N.E. 1987 Development of Riprap Design Criteria by riprap testing in flumes: Phase 1. U.S. Nuclear Regulatory Commission. Washington D.C.

Calculation sheets for verification of riprap channels can be found on pages 49 through 66

Swales crossing the county road along the Lion's Deck area and the road ditch in the Lion's Deck area are verified in the calculation sheets found on pages 67 through 80

STAR POINT MINE RECLAMATION
AS-BUILT CHANNEL DESIGN FLOWS

Diversion Ditch	Contributing Watersheds	Design Flow (cfs)
SPRD-1	RWS-1	0.86
SPRD-1a	RWS-1	0.86
SPRD-2	RWS-2	0.06
SPRD-3	RWS-3	0.03
SPRD-4a	40% RWS-4	0.04
SPRD-4b	RWS-4	0.11
SPRD-5	RWS-5	0.04
SPRD-6	RWS-6	0.09
SPRD-7	RWS-7	0.25
SPRD-8	RWS-1 + 8	1.21
SPRD-9	RWS-2, 3 and 9	0.14
SPRD-10	RWS-2,3,4,5,9, and 10	0.57
SPRD-11	RWS-6 and 11	0.14
SPRD-12	RWS-6,7,11 and 12	0.92
SPRD-14+14a	RWS-14	0.7
SPRD-15	RWS-15	0.51
SPRD-16	RWS-15 and 16	1.22
SPRD-17a	RWS-50	0.61
SPRD-17b	RWS-49	0.18
SPRD-17c	RWS-49, 50, and 52	1.16
SPRD-18a	RWS-48	0.22
SPRD-18b	RWS-48	0.22
SPRD-19a	RWS-47	0.22

Note: When only part of a watershed contributes runoff to a channel or culvert the runoff will be determined by multiplying the total flow by the percentage of the watershed area flowing to the ditch or culvert. In some cases the total watershed runoff may be used.

STAR POINT MINE RECLAMATION
AS-BUILT CHANNEL DESIGN FLOWS

Diversion Ditch	Contributing Watersheds	Design Flow (cfs)
SPRD-19b	RWS-47	0.22
SPRD-19c	RWS-47	0.22
SPRD-20a	60% RWS-46	0.18
SPRD-20b	RWS-46	0.30
SPRD-21	RWS-21	0.81
SPRD-22a	RWS-22	0.85
SPRD-24	RWS-24	5.35
SPRD-25a	RWS-25a	0.78
SPRD-25b	RWS-25b	0.99
SPRD-26	70% RWS-26	1.40
SPRD-26a	60% RWS-26	1.20
SPRD-27	RWS-27	0.09
SPRD-28	RWS-28	1.62
SPRD-29a	RWS-29a	4.72
SPRD-29b	RWS-29b	2.54
SPRD-30	RWS-30	1.67
SPRD-31	RWS-31 which includes all upstream watersheds	145.73 100-yr 6-hr
SPRD-33	RWS-33	2.60
SPRD-35	RWS-35	7.8
SPRD-35a	RWS-35a	0.52
SPRD-36a	RWS-36	1.57
SPRD-40	RWS-40	1.44
SPRD-44	RWS-44	0.3

Note: When only part of a watershed contributes runoff to a channel or culvert the runoff will be determined by multiplying the total flow by the percentage of the watershed area flowing to the ditch or culvert. In some cases the total watershed runoff may be used.

STAR POINT MINE RECLAMATION
AS-BUILT CHANNEL DESIGN FLOWS

Diversion Ditch	Contributing Watersheds	Design Flow (cfs)
SPRD-45	RWS-45	0.35
SPRD-23	RWS-48, 49, 50, 52, + 53	2.30
SPRD-46	RWS-54	0.88
SPRD-47 + 47a	RWS-55	1.07
SPRD-48	RWS-56	0.14
SPRD-49	RWS-57	0.45
Swale-17a	RWS-50	0.61
Swale-17b	RWS-49	0.18
Swale-18a	RWS-48	0.22
Swale-19a+b	RWS-47	0.22
Swale-20a	RWS-46	0.30
Lion's Deck Road Ditch	RWS-51	0.58
SPRC-22	RWS-22	0.85
SPRC-44	RWS-45* and 44	0.65

Note: When only part of a watershed contributes runoff to a channel or culvert the runoff will be determined by multiplying the total flow by the percentage of the watershed area flowing to the ditch or culvert. In some cases the total watershed runoff may be used.

* RWS-45 peak flow is based on the watershed on Exhibit 76la in the addendum to Exhibit 76la which shows a much larger watershed.

STAR POINT MINE AS-BUILT RECLAMATION CHANNEL SUMMARY
10-YEAR 6-HOUR STORM EVENT
(PAGE 1 of 5)

Reclamation Channel	Peak Flow (cfs)	Bottom Width (ft)	Side Slopes (H:V)	Channel Depth (ft)	Min. Bottom Slope (%)	Max. Bottom Slope (%)	Erosion Control Riprap D_{50} (in) or Pyramat	Status
SPRD-1	0.86	2.5	1.71:1	1.17	20.4	36.4	Pyramat	OK
SPRD-1a	0.86	5.0	2.14:1	1.17	22.1	46.8	Pyramat	OK
SPRD-2	0.06	3.0	2:1	1.0	17.8	50.0	Pyramat	OK
SPRD-3	0.03	2.5	2.67:1	0.75	19.6	59.7	Pyramat	OK
SPRD-4a	0.04	3.5	2.33:1	0.75	24.2	51.9	Pyramat	OK
SPRD-4b	0.11	3.0	2.5:1	0.75	19.2	52.9	Pyramat	OK
SPRD-5	0.04	3.0	2.81:1	0.67	7.9	64.7	Pyramat	OK
SPRD-6	0.09	3.0	2.84:1	0.79	15.2	43.0	Pyramat	OK
SPRD-7	0.25	2.5	2.70:1	0.83	15.1	35.1	Pyramat	OK
SPRD-8	1.21	5.5	1.69:1	1.33	10.8	64.5	9	OK
SPRD-9	0.14	3.0	2.4:1	0.83	25.9	42.6	Pyramat	OK
SPRD-10*	0.57	2.5	1.78:1	1.13	20.0	40.2	9	OK
SPRD-10*	0.57	7.0	2.72:1	0.92	17.1	43.6	Pyramat	OK
SPRD-11	0.14	2.2	1.98:1	1.08	30.4	64.5	Pyramat	OK
SPRD-12	0.92	3.5	2.54:1	1.08	22.5	44.1	9	OK

Notes: The ditches described above represent the section of ditch with the **least** capacity to handle runoff. It does not indicate the ditch configuration everywhere.

* The upper portion of SPRD-10 is a riprap channel with the lower portion being a Pyramat channel. See As-built Map 761b for the location of the transition point

Revised: October, 2003

STAR POINT MINE AS-BUILT RECLAMATION CHANNEL SUMMARY
10-YEAR 6-HOUR STORM EVENT
(PAGE 2 of 5)

Reclamation Channel	Peak Flow (cfs)	Bottom Width (ft)	Side Slopes (H:V)	Channel Depth (ft)	Min. Bottom Slope (%)	Max. Bottom Slope (%)	Erosion Control Riprap D_{50} (in) or Pyramat	Status
SPRD-13	Not built, see note on the last page of this table for explanation							
SPRD-14	0.70	2.5	1.71:1	1.17	14.3	34.5	Pyramat	OK
SPRD-14a	0.70	3.0	1.91:1	0.92	21.0	30.5	Pyramat	OK
SPRD-15	0.51	3.0	1.75:1	1.0	19.6	65.0	Pyramat	OK
SPRD-16	1.22	3.5	1.91:1	0.92	21.9	53.8	Pyramat	OK
SPRD-17a	0.61	3.0	1.75:1	1.0	19.2	58.1	Pyramat	OK
SPRD-17b	0.18	2.0	2.53:1	0.79	24.9	51.0	Pyramat	OK
SPRD-17c	1.16	3.0	1.03:1	0.67	38.7	68.0	Pyramat	OK
SPRD-18a	0.22	3.0	2.1:1	0.83	30.3	65.6	Pyramat	OK
SPRD-18b	0.22	3.0	1.64:1	0.67	32.7	44.4	Pyramat	OK
SPRD-19a	0.22	3.0	1.71:1	1.17	28.3	65.5	Pyramat	OK
SPRD-19b	0.22	2.0	2.03:1	1.0	27.7	52.9	Pyramat	OK
SPRD-19c	0.22	2.5	2.1:1	0.83	21.2	54.1	Pyramat	OK
SPRD-20a	0.18	3.5	2.5:1	0.5	27.0	51.1	Pyramat	OK
SPRD-20b	0.3	2.5	1.5:1	1.0	2.6	13.1	Pyramat	OK
SPRD-21	0.81	3.5	1.75:1	0.67	8.5	24.4	Pyramat	OK

Notes: The ditches described above represent the section of ditch with the **least** capacity to handle runoff. It does not indicate the ditch configuration everywhere.

STAR POINT MINE AS-BUILT RECLAMATION CHANNEL SUMMARY
10-YEAR 6-HOUR STORM EVENT
(PAGE 3 of 5)

Reclamation Channel	Peak Flow (cfs)	Bottom Width (ft)	Side Slopes (H:V)	Channel Depth (ft)	Min. Bottom Slope (%)	Max. Bottom Slope (%)	Erosion Control Riprap D_{50} (in) or Pyramat	Status
SPRD-22a	0.85	3.5	2.17:1	1.5	6.4	22.4	6	OK
SPRD-23	2.30	3.0	1.67:1	1.5	28.5	54.1	6	OK
SPRD-24	5.35	4.5	1.86:1	1.21	11.4	31.4	6	OK
SPRD-25a	0.78	2.0	1.71:1	1.17	21.4	61.0	Pyramat	OK
SPRD-25b	0.99	2.3	1.72:1	0.92	13.5	36.2	Pyramat	OK
SPRD-26	1.40	3.0	1.64:1	0.67	10.3	49.2	Pyramat	OK
SPRD-26a	1.20	2.67	1.82:1	0.92	14.7	37.2	Pyramat	OK
SPRD-27	0.09	3.5	1.15:1	1.08	11.8	36.5	Pyramat	OK
SPRD-28	1.62	2.5	1.5:1	1.17	8.3	26.1	Pyramat	OK
SPRD-29a	4.72	3.5	3:1	1.0	12.9	46.9	9	OK
SPRD-29b	2.54	3.0	1.29:1	1.17	12.1	44.3	Pyramat	OK
SPRD-30	1.67	3.0	1.5:1	1.0	18.6	45.7	Pyramat	OK
SPRD-31	145.73@	12	2.27:1	3.42	2.9	14.1	12	OK
SPRD-33	2.60	4.5	1.58:1	3.0	2.9	12.6	6	OK
SPRD-35	7.80	2.5	2.7:1	0.83	6.4	21.2	Pyramat	OK

Notes: The ditches described above represent the section of ditch with the **least** capacity to handle runoff. It does not indicate the ditch configuration everywhere.

Reclamation channels SPRD-32, 34, 39, 41, 42, and 43 are in the Refuse Pile and Sub-soil Stockpile areas and are now part of the SCA permit

@ Peak flow for a 100-year 6-hour storm event since watershed is over 1 square mile

Revised: October, 2003

STAR POINT MINE AS-BUILT RECLAMATION CHANNEL SUMMARY
10-YEAR 6-HOUR STORM EVENT
(PAGE 4 of 5)

Reclamation Channel	Peak Flow (cfs)	Bottom Width (ft)	Side Slopes (H:V)	Channel Depth (ft)	Min. Bottom Slope (%)	Max. Bottom Slope (%)	Erosion Control Riprap D_{50} (in) or Pyramat	Status
SPRD-35a	0.52	2.5	2.7:1	0.83	20.6	25.0	Pyramat	OK
SPRD-36a	1.57	3.0	2.18:1	0.92	9.1	30.8	Pyramat	OK
SPRD-36b	Not built, see note on the last page of this table for explanation							
SPRD-37	Not built, see note on the last page of this table for explanation							
SPRD-38	Not built, see note on the last page of this table for explanation							
SPRD-40	1.44	2.5	1.25:1	0.92	15.9	37.5	Pyramat	OK
SPRD-44	0.3	3.0	1.64:1	0.92	10.6	36.1	Pyramat	OK
SPRD-45	0.35	2.5	1.5:1	1.0	8.3	31.9	Pyramat	OK
Swale-17a	0.61	6	13:1 and 32:1	>0.5	1.0	5.0	Sewer Rock	OK
Swale-17b	0.18	6	24:1 and 19:1	>0.5	1.0	5.0	Sewer Rock	OK
Swale-18a	0.22	8	24:1 and 19:1	>0.5	1.0	5.0	Sewer Rock	OK
Swale-19a	0.22	10	16:1 and 24:1	>0.5	1.0	5.0	Sewer Rock	OK
Swale-19b	0.22	8	13:1 and 32:1	>0.5	1.0	5.0	Sewer Rock	OK
Swale-20a	0.30	10	32:1 and 24:1	>0.5	1.0	5.0	Sewer Rock	OK
Road Ditch	0.58	0	1:1 and 4.5:1	0.67	1.0	4.3	Roadbase	OK

Notes: The ditches described above represent the section of ditch with the **least** capacity to handle runoff. It does not indicate the ditch configuration everywhere.

Reclamation channels SPRD-32, 34, 39, 41, 42, and 43 are in the Refuse Pile and Sub-soil Stockpile area and are now part of the SCA permit

SPRD-13 was not built because it was a section of channel after SPRD-10 and SPRD-12 combined in the design. These two channels never combined, hence SPRD-13 was not needed.

Revised: October, 2003

STAR POINT MINE AS-BUILT RECLAMATION CHANNEL SUMMARY
10-YEAR 6-HOUR STORM EVENT
(PAGE 5 of 5)

Reclamation Channel	Peak Flow (cfs)	Bottom Width (ft)	Side Slopes (H:V)	Channel Depth (ft)	Min. Bottom Slope (%)	Max. Bottom Slope (%)	Erosion Control Riprap D_{50} (in) or Pyramat	Status
SPRD-46	0.88	2.5	2.05:1	0.92	18.9	44.1	Pyramat	OK
SPRD-47 &47a	1.07	2.5	2.33:1	0.75	19.0	40.65	Pyramat	OK
SPRD-48	0.14	2.5	1.58:1	1.00	24.5	43.6	Pyramat	OK
SPRD-49	0.45	2.5	2.63:1	0.67	15.7	47.4	Pyramat	OK

Notes: The ditches described above represent the section of ditch with the **least** capacity to handle runoff. It does not indicate the ditch configuration everywhere.

SPRD-36a was not constructed due to minimal drainage area. During construction it was decided that this channel should be moved to handle a larger drainage area. Hence, SPRD-35a was built instead of SPRD-36b.

SPRD-37 was not built due to an observation that due to a very low slope in the area no channel existed to tie reclamation channel SPRD-37 into. The railroad tracks have created a nearly flat area that caused runoff to spread out and drop its sediment load. Hence it was observed that the channel would fill with sediment within a short time due to the high sediment load of the runoff in this area. It was decided that there was no benefit in building a channel to convey the runoff an extra 300 feet and then letting the runoff spread out. Thus SPRD-37 was not built. The reclamation in this area was configured to promote spreading at the bottom of all side channels.

Four channels were designed to cut through the tramway. The four channels were built (SPRD-25a, 25b, 26, and 26a). However the location of these channels were changed during construction to be in areas where the channels would be most beneficial. Thus SPRD-38 was not built where shown on the design maps.

The short channels adjacent to the main channel such as SPRD-22b did not need to be built due to the width of the main channel. The main channel was simply widened slightly to allow runoff from the undisturbed drainage to flow directly into the main channel.

Channels SPRD-46, 47, 48, and 49 are new channels not include in the reclamation design.

Pyromat Channel Min. Slope, Min. X-Section
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Star Point Mine As-builts
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.047	Assuming well vegetated
Slope	0.079000 ft/ft	
Left Side Slope	1.03 H : V	
Right Side Slope	1.03 H : V	
Bottom Width	2.00 ft	
Discharge	1.70 cfs	

Results		
Depth	0.25 ft	< 0.67
Flow Area	0.6 ft²	
Wetted Perimeter	2.70 ft	
Top Width	2.50 ft	
Critical Depth	0.27 ft	
Critical Slope	0.057801 ft/ft	
Velocity	3.08 ft/s	
Velocity Head	0.15 ft	
Specific Energy	0.39 ft	
Froude Number	1.16	
Flow Type	Supercritical	

Freeboard = 0.42' = 5"

Pyromat Channel Max. Slope, Min. X-Section
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Star Point Mine As-builts
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.025	Assuming no vegetation
Slope	0.680000 ft/ft	
Left Side Slope	1.03 H : V	
Right Side Slope	1.03 H : V	
Bottom Width	2.00 ft	
Discharge	1.70 cfs	

Results	
Depth	0.09 ft
Flow Area	0.2 ft²
Wetted Perimeter	2.25 ft
Top Width	2.18 ft
Critical Depth	0.27 ft
Critical Slope	0.016354 ft/ft
Velocity	9.23 ft/s → non-vegetated maximum velocity
Velocity Head	1.32 ft
Specific Energy	1.41 ft
Froude Number	5.60
Flow Type	Supercritical

short term (½ hr) = 20 ft/s

long term (50 hrs) = 10 ft/s

See pages 91 and 93

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SPRD-10 Min, Slope, Vegetated, Pyramat
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Star Point Mine Reclamation
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.047	vegetated
Slope	0.171000	ft/ft
Left Side Slope	2.72	H : V
Right Side Slope	2.72	H : V
Bottom Width	7.00	ft
Discharge	0.57	cfs

Results		
Depth	0.05	ft < 0.92
Flow Area	0.3	ft²
Wetted Perimeter	7.27	ft
Top Width	7.26	ft
Critical Depth	0.06	ft
Critical Slope	0.083803	ft/ft
Velocity	1.69	ft/s
Velocity Head	0.04	ft
Specific Energy	0.09	ft
Froude Number	1.38	
Flow Type	Supercritical	

freeboard = 0.87

SPRD-10 Max, Slope, Unvegetated, Pyramat
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Star Point Mine Reclamation
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.025	unvegetated
Slope	0.436000 ft/ft	
Left Side Slope	2.72 H : V	
Right Side Slope	2.72 H : V	
Bottom Width	7.00 ft	
Discharge	0.57 cfs	

Results		
Depth	0.02 ft	
Flow Area	0.2 ft²	
Wetted Perimeter	7.14 ft	
Top Width	7.13 ft	
Critical Depth	0.06 ft	
Critical Slope	0.023705 ft/ft	
Velocity	3.29 ft/s	< 10 fps
Velocity Head	0.17 ft	
Specific Energy	0.19 ft	
Froude Number	3.72	
Flow Type	Supercritical	

SPRD-20b Min Slope, Vegetated Pyramat
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Star Point Mine Reclamation
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.047	vegetated
Slope	0.026000	ft/ft
Left Side Slope	1.50	H : V
Right Side Slope	1.50	H : V
Bottom Width	2.50	ft
Discharge	0.30	cfs

Results		
Depth	0.10 ft	< 1.0'
Flow Area	0.3 ft^2	
Wetted Perimeter	2.88 ft	
Top Width	2.81 ft	
Critical Depth	0.08 ft	
Critical Slope	0.079031 ft/ft	
Velocity	1.08 ft/s	
Velocity Head	0.02 ft	
Specific Energy	0.12 ft	
Froude Number	0.60	
Flow Type	Subcritical	

freeboard = 0.9'

SPRD-20b Max Slope, Unvegetated Pyramat
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Star Point Mine Reclamation
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.025	unvegetated
Slope	0.131000	ft/ft
Left Side Slope	1.50	H : V
Right Side Slope	1.50	H : V
Bottom Width	2.50	ft
Discharge	0.30	cfs

Results		
Depth	0.04	ft
Flow Area	0.1	ft²
Wetted Perimeter	2.66	ft
Top Width	2.63	ft
Critical Depth	0.08	ft
Critical Slope	0.022360	ft/ft
Velocity	2.63	ft/s << 10 fps
Velocity Head	0.11	ft
Specific Energy	0.15	ft
Froude Number	2.23	
Flow Type	Supercritical	

SPRD-29b Min Slope, Vegetated Pyramat
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Star Point Mine Reclamation
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.047	Vegetated
Slope	0.121000	ft/ft
Left Side Slope	1.29	H : V
Right Side Slope	1.29	H : V
Bottom Width	3.00	ft
Discharge	2.54	cfs

Results		
Depth	0.21	ft < 1.17
Flow Area	0.7	ft²
Wetted Perimeter	3.70	ft
Top Width	3.55	ft
Critical Depth	0.27	ft
Critical Slope	0.054918	ft/ft
Velocity	3.63	ft/s
Velocity Head	0.20	ft
Specific Energy	0.42	ft
Froude Number	1.44	
Flow Type	Supercritical	

freeboard = .96'

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SPRD-29b Max Slope, Unvegetated Pyramat
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Star Point Mine Reclamation
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.025	unvegetated
Slope	0.443000	ft/ft
Left Side Slope	1.29	H : V
Right Side Slope	1.29	H : V
Bottom Width	3.00	ft
Discharge	2.54	cfs

Results		
Depth	0.10	ft
Flow Area	0.3	ft²
Wetted Perimeter	3.32	ft
Top Width	3.26	ft
Critical Depth	0.27	ft
Critical Slope	0.015538	ft/ft
Velocity	8.16	ft/s < 10 fps
Velocity Head	1.03	ft
Specific Energy	1.13	ft
Froude Number	4.65	
Flow Type	Supercritical	

SPRD-35 Min. Slope, Vegetated Pyramat
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Star Point Mine Reclamation
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.047	vegetated
Slope	0.064000	ft/ft
Left Side Slope	2.70	H : V
Right Side Slope	2.70	H : V
Bottom Width	2.50	ft
Discharge	7.80	cfs

Results		
Depth	0.50	ft <
Flow Area	1.9	ft²
Wetted Perimeter	5.39	ft
Top Width	5.21	ft
Critical Depth	0.55	ft
Critical Slope	0.045831	ft/ft
Velocity	4.04	ft/s
Velocity Head	0.25	ft
Specific Energy	0.75	ft
Froude Number	1.17	
Flow Type	Supercritical	

SPRD-35 Max. Slope, Unvegetated Pyramat
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Star Point Mine Reclamation
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.025	unvegetated
Slope	0.212000	ft/ft
Left Side Slope	2.70	H : V
Right Side Slope	2.70	H : V
Bottom Width	2.50	ft
Discharge	7.80	cfs

Results		
Depth	0.26	ft
Flow Area	0.8	ft²
Wetted Perimeter	3.98	ft
Top Width	3.88	ft
Critical Depth	0.55	ft
Critical Slope	0.012967	ft/ft
Velocity	9.54	ft/s < 10 fps ok
Velocity Head	1.41	ft
Specific Energy	1.67	ft
Froude Number	3.66	
Flow Type	Supercritical	

SPRD-8 Min. Slope
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Star Point Mine Reclamation
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.045	$D_{50} = 9''$
Slope	0.108000 ft/ft	
Left Side Slope	1.69 H : V	
Right Side Slope	1.69 H : V	
Bottom Width	5.50 ft	
Discharge	1.21 cfs	

Results		
Depth	0.10 ft	< 1.37' freeboard = 1.27'
Flow Area	0.5 ft²	
Wetted Perimeter	5.88 ft	
Top Width	5.83 ft	
Critical Depth	0.11 ft	
Critical Slope	0.063652 ft/ft	
Velocity	2.21 ft/s	
Velocity Head	0.08 ft	
Specific Energy	0.17 ft	
Froude Number	1.27	
Flow Type	Supercritical	

SPRD-8 Max. Slope
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Star Point Mine Reclamation
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.060	$n = 0.0456 (0.645 \times 9)^{0.159} = 0.06$
Slope	0.645000 ft/ft	$D_{50} = 9''$
Left Side Slope	1.69 H : V	
Right Side Slope	1.69 H : V	
Bottom Width	5.50 ft	
Discharge	1.21 cfs	

Results		
Depth	0.07 ft	
Flow Area	0.4 ft²	
Wetted Perimeter	5.76 ft	
Top Width	5.73 ft	
Critical Depth	0.11 ft	
Critical Slope	0.112289 ft/ft	
Velocity	3.21 ft/s	< 9 fps
Velocity Head	0.16 ft	
Specific Energy	0.23 ft	
Froude Number	2.21	
Flow Type	Supercritical	

SPRD-10 Min. Slope
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Star Point Mine Reclamation
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.050	D_{50} = 9"
Slope	0.200000 ft/ft	
Left Side Slope	1.78 H : V	
Right Side Slope	1.78 H : V	
Bottom Width	2.50 ft	
Discharge	0.57 cfs	

Results		
Depth	0.09 ft	< 1.13' freeboard = 1.04'
Flow Area	0.2 ft²	
Wetted Perimeter	2.85 ft	
Top Width	2.81 ft	
Critical Depth	0.11 ft	
Critical Slope	0.079377 ft/ft	
Velocity	2.48 ft/s	< 9 fps ok
Velocity Head	0.10 ft	
Specific Energy	0.18 ft	
Froude Number	1.52	
Flow Type	Supercritical	

SPRD-10 Max. Slope
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Star Point Mine Reclamation
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.056	$D_{50} = 9''$
Slope	0.402000 ft/ft	
Left Side Slope	1.78 H : V	
Right Side Slope	1.78 H : V	
Bottom Width	2.50 ft	
Discharge	0.57 cfs	

Results	
Depth	0.08 ft
Flow Area	0.2 ft²
Wetted Perimeter	2.81 ft
Top Width	2.77 ft
Critical Depth	0.11 ft
Critical Slope	0.098816 ft/ft
Velocity	2.88 ft/s < 9 fps ok
Velocity Head	0.13 ft
Specific Energy	0.20 ft
Froude Number	1.90
Flow Type	Supercritical

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SPRD-12 Min. Slope
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Star Point Mine Reclamation
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.051	D_{50} = 9"
Slope	0.225000 ft/ft	
Left Side Slope	2.54 H : V	
Right Side Slope	2.54 H : V	
Bottom Width	3.50 ft	
Discharge	0.92 cfs	

Results		
Depth	0.09 ft	< 1.08' freeboard = 0.99' ok
Flow Area	0.3 ft²	
Wetted Perimeter	4.00 ft	
Top Width	3.97 ft	
Critical Depth	0.13 ft	
Critical Slope	0.079033 ft/ft	
Velocity	2.69 ft/s	
Velocity Head	0.11 ft	
Specific Energy	0.20 ft	
Froude Number	1.61	
Flow Type	Supercritical	

SPRD-12 Max. Slope
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Star Point Mine Reclamation
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.057	$D_{50} = 9''$
Slope	0.441000 ft/ft	
Left Side Slope	2.54 H : V	
Right Side Slope	2.54 H : V	
Bottom Width	3.50 ft	
Discharge	0.92 cfs	

Results		
Depth	0.08 ft	
Flow Area	0.3 ft²	
Wetted Perimeter	3.94 ft	
Top Width	3.91 ft	
Critical Depth	0.13 ft	
Critical Slope	0.098032 ft/ft	
Velocity	3.10 ft/s	< 9 fps ok
Velocity Head	0.15 ft	
Specific Energy	0.23 ft	
Froude Number	1.98	
Flow Type	Supercritical	

SPRD-22a Min. Slope
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Star Point Mine Reclamation
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.039	D_{50} = 6"
Slope	0.064000 ft/ft	
Left Side Slope	2.17 H : V	
Right Side Slope	2.17 H : V	
Bottom Width	3.50 ft	
Discharge	0.85 cfs	

Results		
Depth	0.11 ft	< 1.5' freeboard = 0.1.39' ok
Flow Area	0.4 ft²	
Wetted Perimeter	4.02 ft	
Top Width	3.97 ft	
Critical Depth	0.12 ft	
Critical Slope	0.047556 ft/ft	
Velocity	2.08 ft/s	
Velocity Head	0.07 ft	
Specific Energy	0.18 ft	
Froude Number	1.14	
Flow Type	Supercritical	

SPRD-22a Max. Slope
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Star Point Mine Reclamation
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.048	D_{50} = 6"
Slope	0.224000 ft/ft	
Left Side Slope	2.17 H : V	
Right Side Slope	2.17 H : V	
Bottom Width	3.50 ft	
Discharge	0.85 cfs	

Results		
Depth	0.08 ft	
Flow Area	0.3 ft²	
Wetted Perimeter	3.90 ft	
Top Width	3.87 ft	
Critical Depth	0.12 ft	
Critical Slope	0.070351 ft/ft	
Velocity	2.73 ft/s	< 7.5 fps ok
Velocity Head	0.12 ft	
Specific Energy	0.20 ft	
Froude Number	1.69	
Flow Type	Supercritical	

SPRD-24 Min. Slope
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Star Point Mine Reclamation
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.043	$D_{50} = 6''$
Slope	0.114000 ft/ft	
Left Side Slope	1.86 H : V	
Right Side Slope	1.86 H : V	
Bottom Width	4.50 ft	
Discharge	5.35 cfs	

Results		
Depth	0.25 ft	< 1.21' freeboard = 0.96' ok
Flow Area	1.2 ft²	
Wetted Perimeter	5.56 ft	
Top Width	5.43 ft	
Critical Depth	0.34 ft	
Critical Slope	0.041658 ft/ft	
Velocity	4.31 ft/s	
Velocity Head	0.29 ft	
Specific Energy	0.54 ft	
Froude Number	1.59	
Flow Type	Supercritical	

SPRD-23 Maximum Slope
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Star Point Reclamation
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.055	$D_{50} = 6''$
Slope	0.541000 ft/ft	
Left Side Slope	1.67 H : V	
Right Side Slope	1.67 H : V	
Bottom Width	3.00 ft	
Discharge	2.30 cfs	

Results		
Depth	0.14 ft	
Flow Area	0.5 ft²	
Wetted Perimeter	3.55 ft	
Top Width	3.47 ft	
Critical Depth	0.25 ft	
Critical Slope	0.076158 ft/ft	
Velocity	5.05 ft/s	< 7.5 fps ok
Velocity Head	0.40 ft	
Specific Energy	0.54 ft	
Froude Number	2.46	
Flow Type	Supercritical	

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SPRD-23 Minimum Slope
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Star Point Reclamation
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.050	$D_{50} = 6''$
Slope	0.285000 ft/ft	
Left Side Slope	1.67 H : V	
Right Side Slope	1.67 H : V	
Bottom Width	3.00 ft	
Discharge	2.30 cfs	

Results		
Depth	0.16 ft	< 1.5'
Flow Area	0.5 ft²	
Wetted Perimeter	3.62 ft	
Top Width	3.53 ft	
Critical Depth	0.25 ft	
Critical Slope	0.062088 ft/ft	
Velocity	4.40 ft/s	
Velocity Head	0.30 ft	
Specific Energy	0.46 ft	
Froude Number	2.01	
Flow Type	Supercritical	

freeboard = 1.34'

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SPRD-24 Max. Slope
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Star Point Mine Reclamation
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.050	$D_{50} = 6''$
Slope	0.314000 ft/ft	
Left Side Slope	1.86 H : V	
Right Side Slope	1.86 H : V	
Bottom Width	4.50 ft	
Discharge	5.35 cfs	

Results	
Depth	0.20 ft
Flow Area	1.0 ft²
Wetted Perimeter	5.36 ft
Top Width	5.26 ft
Critical Depth	0.34 ft
Critical Slope	0.057497 ft/ft
Velocity	5.38 ft/s < 7.5 fps ok
Velocity Head	0.45 ft
Specific Energy	0.65 ft
Froude Number	2.18
Flow Type	Supercritical

SPRD-29a Min. Slope
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Star Point Mine Reclamation
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.047	$D_{50} = 9''$
Slope	0.129000 ft/ft	
Left Side Slope	3.00 H : V	
Right Side Slope	3.00 H : V	
Bottom Width	3.50 ft	
Discharge	4.72 cfs	

Results		
Depth	0.26 ft	< 1.0' freeboard = 0.74' ok
Flow Area	1.1 ft²	
Wetted Perimeter	5.17 ft	
Top Width	5.09 ft	
Critical Depth	0.35 ft	
Critical Slope	0.049801 ft/ft	
Velocity	4.16 ft/s	
Velocity Head	0.27 ft	
Specific Energy	0.53 ft	
Froude Number	1.55	
Flow Type	Supercritical	

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SPRD-29a Max. Slope
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Star Point Mine Reclamation
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.057	$D_{50} = 9''$
Slope	0.469000 ft/ft	
Left Side Slope	3.00 H : V	
Right Side Slope	3.00 H : V	
Bottom Width	3.50 ft	
Discharge	4.72 cfs	

Results		
Depth	0.20 ft	
Flow Area	0.8 ft²	
Wetted Perimeter	4.80 ft	
Top Width	4.73 ft	
Critical Depth	0.35 ft	
Critical Slope	0.074192 ft/ft	
Velocity	5.60 ft/s	< 9 fps ok
Velocity Head	0.49 ft	
Specific Energy	0.69 ft	
Froude Number	2.34	
Flow Type	Supercritical	

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SPRD-31 Min. Slope
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Star Point Mine Reclamation
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.039	D_{50} = 12"
Slope	0.029000	ft/ft
Left Side Slope	2.27	H : V
Right Side Slope	2.27	H : V
Bottom Width	12.00	ft
Discharge	145.73	cfs

Results		
Depth	1.38	ft < 3.42'
Flow Area	20.8	ft²
Wetted Perimeter	18.82	ft
Top Width	18.24	ft
Critical Depth	1.50	ft
Critical Slope	0.021174	ft/ft
Velocity	7.01	ft/s
Velocity Head	0.76	ft
Specific Energy	2.14	ft
Froude Number	1.16	
Flow Type	Supercritical	

freeboard = 2.04'

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SPRD-31 Max. Slope
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Star Point Mine Reclamation
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.050	D_{50} = 12"
Slope	0.141000 ft/ft	
Left Side Slope	2.27 H : V	
Right Side Slope	2.27 H : V	
Bottom Width	12.00 ft	
Discharge	145.73 cfs	

Results		
Depth	1.01 ft	
Flow Area	14.4 ft²	
Wetted Perimeter	17.01 ft	
Top Width	16.59 ft	
Critical Depth	1.50 ft	
Critical Slope	0.034962 ft/ft	
Velocity	10.09 ft/s	< 10.45 fps OK
Velocity Head	1.58 ft	
Specific Energy	2.59 ft	
Froude Number	1.91	
Flow Type	Supercritical	

SPRD-33 Min. Slope
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Star Point Mine Reclamation
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	$D_{50} = 6''$
Slope	0.029000 ft/ft	
Left Side Slope	1.58 H : V	
Right Side Slope	1.58 H : V	
Bottom Width	4.50 ft	
Discharge	2.60 cfs	

Results		
Depth	0.22 ft	< 3.0' freeboard = 2.78'
Flow Area	1.0 ft²	
Wetted Perimeter	5.31 ft	
Top Width	5.18 ft	
Critical Depth	0.21 ft	
Critical Slope	0.030667 ft/ft	
Velocity	2.48 ft/s	
Velocity Head	0.10 ft	
Specific Energy	0.31 ft	
Froude Number	0.97	
Flow Type	Subcritical	

SPRD-33 Max. Slope
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Star Point Mine Reclamation
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.044	$D_{50} = 6''$
Slope	0.126000 ft/ft	
Left Side Slope	1.58 H : V	
Right Side Slope	1.58 H : V	
Bottom Width	4.50 ft	
Discharge	2.60 cfs	

Results		
Depth	0.16 ft	
Flow Area	0.8 ft²	
Wetted Perimeter	5.10 ft	
Top Width	5.01 ft	
Critical Depth	0.21 ft	
Critical Slope	0.048977 ft/ft	
Velocity	3.41 ft/s	< 7 fps ∴ OK
Velocity Head	0.18 ft	
Specific Energy	0.34 ft	
Froude Number	1.54	
Flow Type	Supercritical	

Swale 17a Minimum Slope
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Star Point Mine Reclamation
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Slope	0.010000	ft/ft
Left Side Slope	13.00	H : V
Right Side Slope	32.00	H : V
Bottom Width	6.00	ft
Discharge	0.61	cfs

Results		
Depth	0.09	ft < 0.5" freeboard = 0.41'
Flow Area	0.7	ft²
Wetted Perimeter	10.03	ft
Top Width	10.02	ft
Critical Depth	0.06	ft
Critical Slope	0.034949	ft/ft
Velocity	0.85	ft/s
Velocity Head	0.01	ft
Specific Energy	0.10	ft
Froude Number	0.56	
Flow Type	Subcritical	

Swale 17a Maximum Slope
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Star Point Mine Reclamation
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Slope	0.050000	ft/ft
Left Side Slope	13.00	H : V
Right Side Slope	32.00	H : V
Bottom Width	6.00	ft
Discharge	0.61	cfs

Results		
Depth	0.06	ft
Flow Area	0.4	ft²
Wetted Perimeter	8.57	ft
Top Width	8.56	ft
Critical Depth	0.06	ft
Critical Slope	0.034949	ft/ft
Velocity	1.47	ft/s < 5 fps ok
Velocity Head	0.03	ft
Specific Energy	0.09	ft
Froude Number	1.18	
Flow Type	Supercritical	

Swale 17b Minimum Slope
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Star Point Mine Reclamation
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Slope	0.010000	ft/ft
Left Side Slope	24.00	H : V
Right Side Slope	19.00	H : V
Bottom Width	6.00	ft
Discharge	0.18	cfs

Results		
Depth	0.04	ft < 0.5' freeboard = 0.46' ok
Flow Area	0.3	ft²
Wetted Perimeter	7.94	ft
Top Width	7.93	ft
Critical Depth	0.03	ft
Critical Slope	0.043870	ft/ft
Velocity	0.57	ft/s
Velocity Head	0.01	ft
Specific Energy	0.05	ft
Froude Number	0.51	
Flow Type	Subcritical	

Swale 17b Maximum Slope
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Star Point Mine Reclamation
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Slope	0.050000	ft/ft
Left Side Slope	24.00	H : V
Right Side Slope	19.00	H : V
Bottom Width	6.00	ft
Discharge	0.18	cfs

Results		
Depth	0.03	ft
Flow Area	0.2	ft²
Wetted Perimeter	7.21	ft
Top Width	7.21	ft
Critical Depth	0.03	ft
Critical Slope	0.043870	ft/ft
Velocity	0.97	ft/s < 5 fps ok
Velocity Head	0.01	ft
Specific Energy	0.04	ft
Froude Number	1.06	
Flow Type	Supercritical	

Swale 18a Minimum Slope
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Star Point Mine Reclamation
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Slope	0.010000	ft/ft
Left Side Slope	24.00	H : V
Right Side Slope	19.00	H : V
Bottom Width	8.00	ft
Discharge	0.22	cfs

Results		
Depth	0.04	ft < 0.5' freeboard = 0.46' ok
Flow Area	0.4	ft²
Wetted Perimeter	9.86	ft
Top Width	9.86	ft
Critical Depth	0.03	ft
Critical Slope	0.044223	ft/ft
Velocity	0.57	ft/s
Velocity Head	0.01	ft
Specific Energy	0.05	ft
Froude Number	0.51	
Flow Type	Subcritical	

Swale 18a Maximum Slope
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Star Point Mine Reclamation
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.030
Slope	0.050000 ft/ft
Left Side Slope	24.00 H : V
Right Side Slope	19.00 H : V
Bottom Width	8.00 ft
Discharge	0.22 cfs

Results	
Depth	0.03 ft
Flow Area	0.2 ft²
Wetted Perimeter	9.16 ft
Top Width	9.16 ft
Critical Depth	0.03 ft
Critical Slope	0.044223 ft/ft
Velocity	0.95 ft/s < 5.0 fps ok
Velocity Head	0.01 ft
Specific Energy	0.04 ft
Froude Number	1.06
Flow Type	Supercritical

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Project Engineer: Tom Suchoski

Swale 19a Minimum Slope
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Star Point Mine Reclamation
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Slope	0.010000	ft/ft
Left Side Slope	16.00	H : V
Right Side Slope	24.00	H : V
Bottom Width	10.00	ft
Discharge	0.22	cfs

Results		
Depth	0.04	ft < 0.5' freeboard = 0.46' ok
Flow Area	0.4	ft²
Wetted Perimeter	11.53	ft
Top Width	11.53	ft
Critical Depth	0.02	ft
Critical Slope	0.045988	ft/ft
Velocity	0.54	ft/s
Velocity Head	4.46e-3	ft
Specific Energy	0.04	ft
Froude Number	0.50	
Flow Type	Subcritical	

Swale 19a Maximum Slope
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Star Point Mine Reclamation
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Slope	0.050000	ft/ft
Left Side Slope	16.00	H : V
Right Side Slope	24.00	H : V
Bottom Width	10.00	ft
Discharge	0.22	cfs

Results		
Depth	0.02	ft
Flow Area	0.2	ft²
Wetted Perimeter	10.95	ft
Top Width	10.95	ft
Critical Depth	0.02	ft
Critical Slope	0.045990	ft/ft
Velocity	0.89	ft/s < 5 fps ok
Velocity Head	0.01	ft
Specific Energy	0.04	ft
Froude Number	1.04	
Flow Type	Supercritical	

Swale 19b Minimum Slope
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Star Point Mine Reclamation
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Slope	0.010000	ft/ft
Left Side Slope	13.00	H : V
Right Side Slope	32.00	H : V
Bottom Width	8.00	ft
Discharge	0.22	cfs

Results		
Depth	0.04	ft < 0.5' freeboard = 0.46' ok
Flow Area	0.4	ft²
Wetted Perimeter	9.94	ft
Top Width	9.94	ft
Critical Depth	0.03	ft
Critical Slope	0.044282	ft/ft
Velocity	0.57	ft/s
Velocity Head	0.01	ft
Specific Energy	0.05	ft
Froude Number	0.51	
Flow Type	Subcritical	

Swale 19b Maximum Slope
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Star Point Mine Reclamation
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Slope	0.050000	ft/ft
Left Side Slope	13.00	H : V
Right Side Slope	32.00	H : V
Bottom Width	8.00	ft
Discharge	0.22	cfs

Results		
Depth	0.03	ft
Flow Area	0.2	ft²
Wetted Perimeter	9.21	ft
Top Width	9.21	ft
Critical Depth	0.03	ft
Critical Slope	0.044282	ft/ft
Velocity	0.95	ft/s < 5 fps ok
Velocity Head	0.01	ft
Specific Energy	0.04	ft
Froude Number	1.06	
Flow Type	Supercritical	

Swale 20a Minimum Slope
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Star Point Mine Reclamation
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Slope	0.010000	ft/ft
Left Side Slope	32.00	H : V
Right Side Slope	24.00	H : V
Bottom Width	10.00	ft
Discharge	0.30	cfs

Results		
Depth	0.05	ft < 0.5' freeboard = 0.45' ok
Flow Area	0.5	ft²
Wetted Perimeter	12.54	ft
Top Width	12.54	ft
Critical Depth	0.03	ft
Critical Slope	0.043512	ft/ft
Velocity	0.59	ft/s
Velocity Head	0.01	ft
Specific Energy	0.05	ft
Froude Number	0.51	
Flow Type	Subcritical	

Swale 20a Maximum Slope
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Star Point Mine Reclamation
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Slope	0.050000	ft/ft
Left Side Slope	32.00	H : V
Right Side Slope	24.00	H : V
Bottom Width	10.00	ft
Discharge	0.30	cfs

Results		
Depth	0.03	ft
Flow Area	0.3	ft²
Wetted Perimeter	11.59	ft
Top Width	11.59	ft
Critical Depth	0.03	ft
Critical Slope	0.043500	ft/ft
Velocity	0.98	ft/s < 5 fps ok
Velocity Head	0.01	ft
Specific Energy	0.04	ft
Froude Number	1.07	
Flow Type	Supercritical	

Road Ditch Minimum Slope
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Star Point Mine Reclamation
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Slope	0.010000	ft/ft
Left Side Slope	1.00	H : V
Right Side Slope	4.50	H : V
Bottom Width	0.00	ft
Discharge	0.58	cfs

Results		
Depth	0.37	ft < 0.67
Flow Area	0.4	ft²
Wetted Perimeter	2.24	ft
Top Width	2.05	ft
Critical Depth	0.31	ft
Critical Slope	0.027628	ft/ft
Velocity	1.52	ft/s
Velocity Head	0.04	ft
Specific Energy	0.41	ft
Froude Number	0.62	
Flow Type	Subcritical	

freeboard = 0.3'
The road also slopes towards the ditch adding an additional 6" of depth. Thus there is plenty of freeboard. See Channel X-section sheet.

Road Ditch Maximum Slope
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Star Point Mine Reclamation
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.030
Slope	0.043000 ft/ft
Left Side Slope	1.00 H : V
Right Side Slope	4.50 H : V
Bottom Width	0.00 ft
Discharge	0.58 cfs

Results	
Depth	0.28 ft
Flow Area	0.2 ft²
Wetted Perimeter	1.71 ft
Top Width	1.56 ft
Critical Depth	0.31 ft
Critical Slope	0.027628 ft/ft
Velocity	2.63 ft/s < 5.0 fps ∴ ok
Velocity Head	0.11 ft
Specific Energy	0.39 ft
Froude Number	1.23
Flow Type	Supercritical

Culvert Verification

There are two culverts under the county road installed during reclamation SPRC-22 and SPRC-44

SPRC-22

Q_{10-6} = 0.85 cfs
Diameter = 24"
mitred inlet.
HW/D = 2.0
Inlet capacity = 22 cfs page 84

Barrel Capacity = 12.25 cfs. See page 82

12.25 cfs >> 0.85 cfs ∴ ok

SPRC-44

Q_{10-6} = 0.65 cfs
Diameter = 24"
mitred inlet
HW/D = 1.5

Inlet capacity = 18 cfs page 84

Barrel Capacity = 17.3 cfs. See page 83

17.3 cfs >> 0.65 cfs ∴ ok

SPRC-22 FULL FLOW CAPACITY
Worksheet for Circular Channel

Project Description	
Worksheet	Star Point Mine Reclamation
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Capacity

Input Data		
Mannings Coefficient	0.024	
Slope	0.010000	ft/ft
Diameter	24	in

Results		
Depth	2.00	ft
Discharge	12.25	cfs >> 0.85 ∴ ok
Flow Area	3.1	ft²
Wetted Perimeter	6.28	ft
Top Width	0.00	ft
Critical Depth	1.26	ft
Percent Full	100.0	%
Critical Slope	0.019219	ft/ft
Velocity	3.90	ft/s
Velocity Head	0.24	ft
Specific Energy	2.24	ft
Froude Number	0.00	
Maximum Discharge	13.18	cfs
Discharge Full	12.25	cfs
Slope Full	0.010000	ft/ft
Flow Type	N/A	

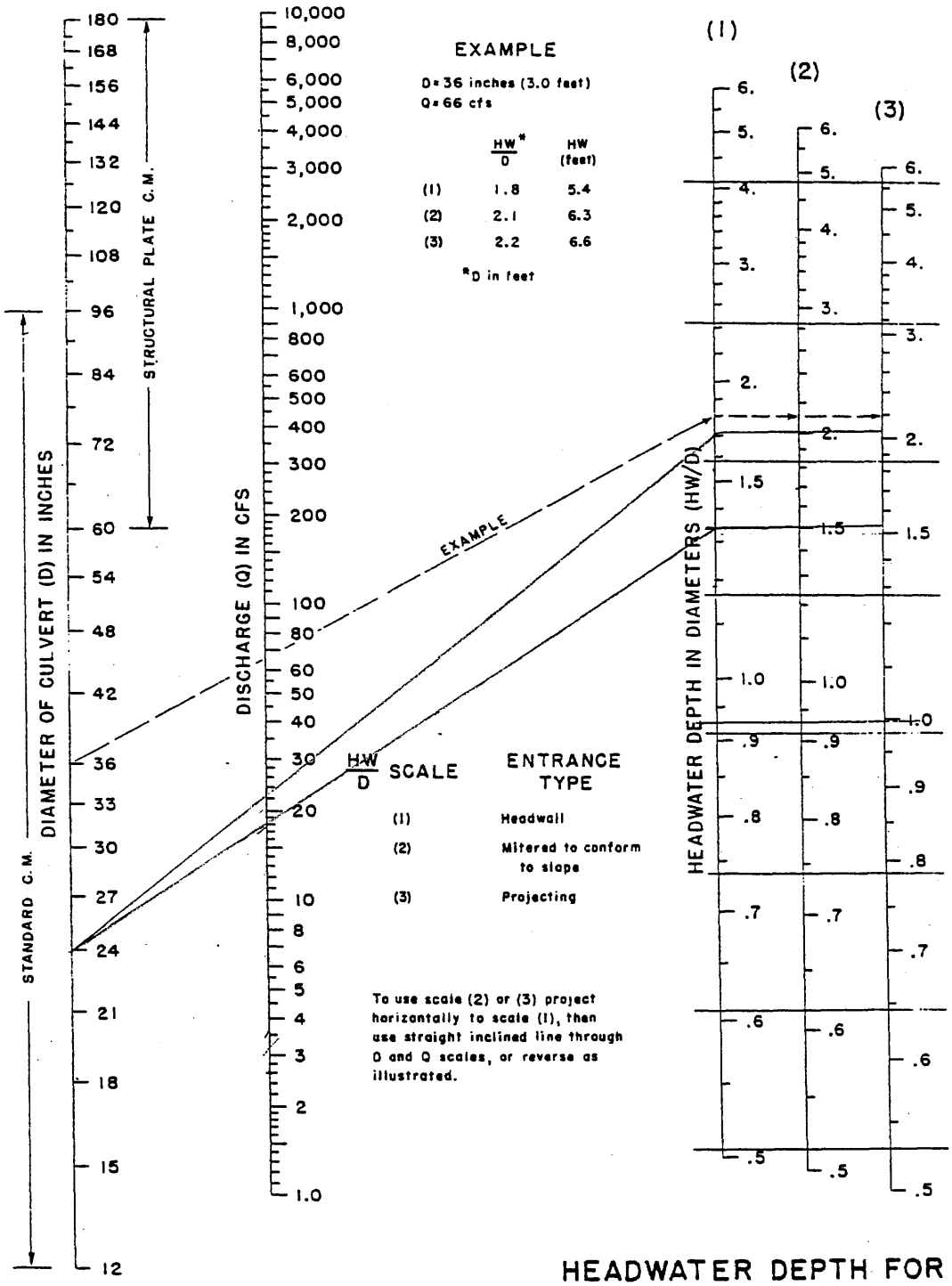
SPRC-44 FULL FLOW CAPACITY
Worksheet for Circular Channel

Project Description	
Worksheet	Star Point Mine Reclamation
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Capacity

Input Data	
Mannings Coefficient	0.024
Slope	0.020000 ft/ft
Diameter	24 in

Results	
Depth	2.00 ft
Discharge	17.33 cfs >7 0.65 cfs ok
Flow Area	3.1 ft²
Wetted Perimeter	6.28 ft
Top Width	0.00 ft
Critical Depth	1.50 ft
Percent Full	100.0 %
Critical Slope	0.024032 ft/ft
Velocity	5.52 ft/s
Velocity Head	0.47 ft
Specific Energy	2.47 ft
Froude Number	0.00
Maximum Discharge	18.64 cfs
Discharge Full	17.33 cfs
Slope Full	0.020000 ft/ft
Flow Type	N/A

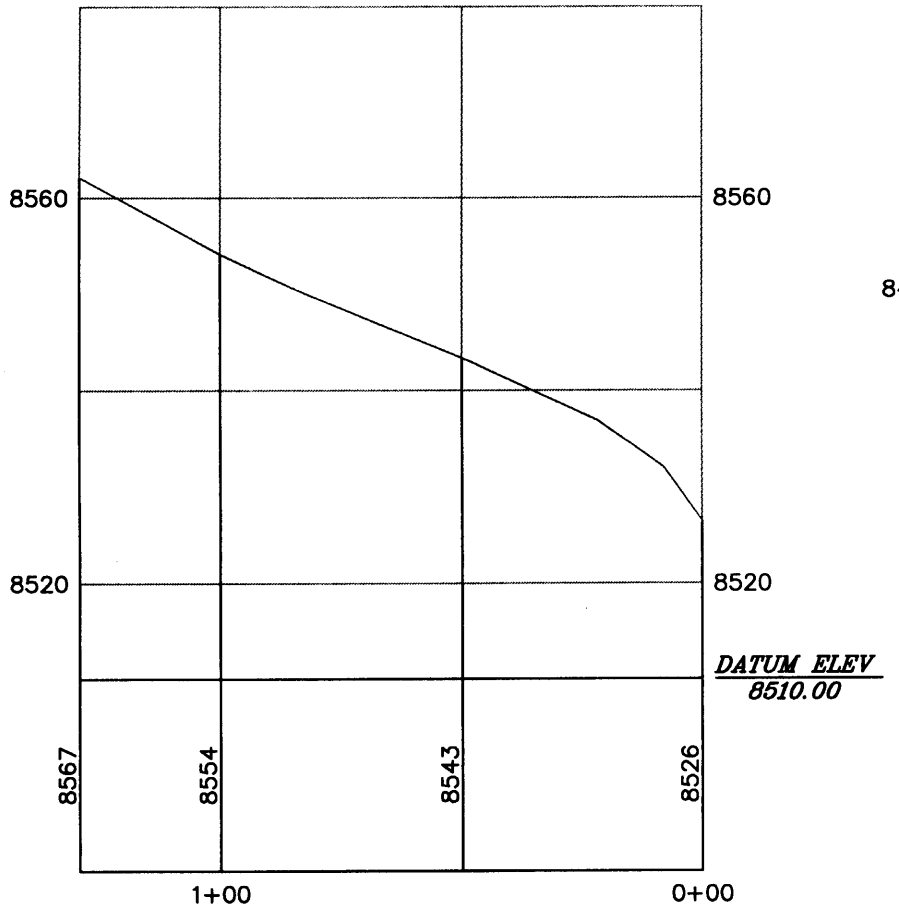
CHART 5



HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

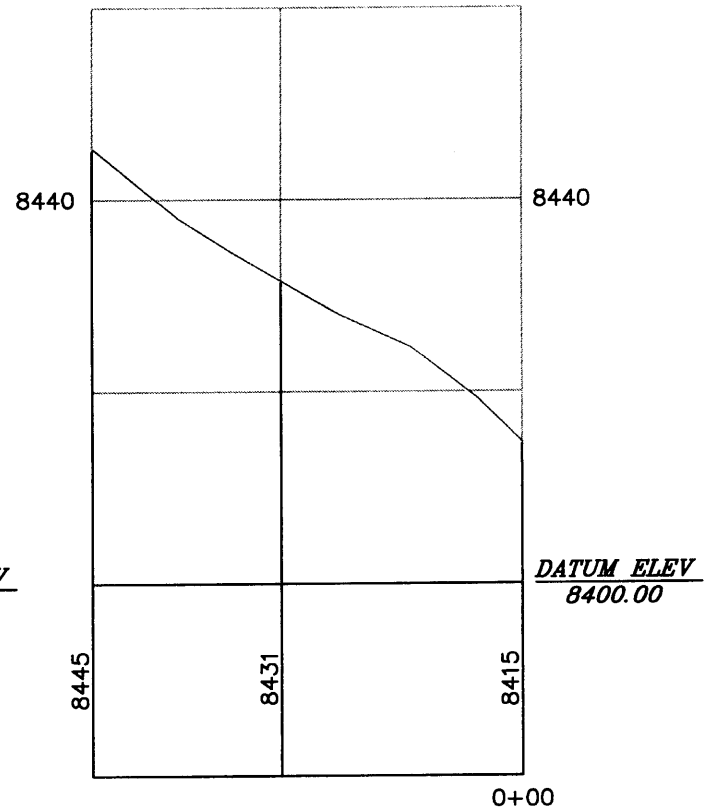
BUREAU OF PUBLIC ROADS JAN. 1963

Ref (U.S. Dept. of Transportation, 1977)



PROFILE SPRD-1

HORIZONTAL SCALE: 1=40'
VERTICAL SCALE: 1=20'



PROFILE SPRD-1a

HORIZONTAL SCALE: 1=40'
VERTICAL SCALE: 1=20'

FIGURE 1. AS-BUILT RECLAMATION CHANNEL PROFILES

EarthFax

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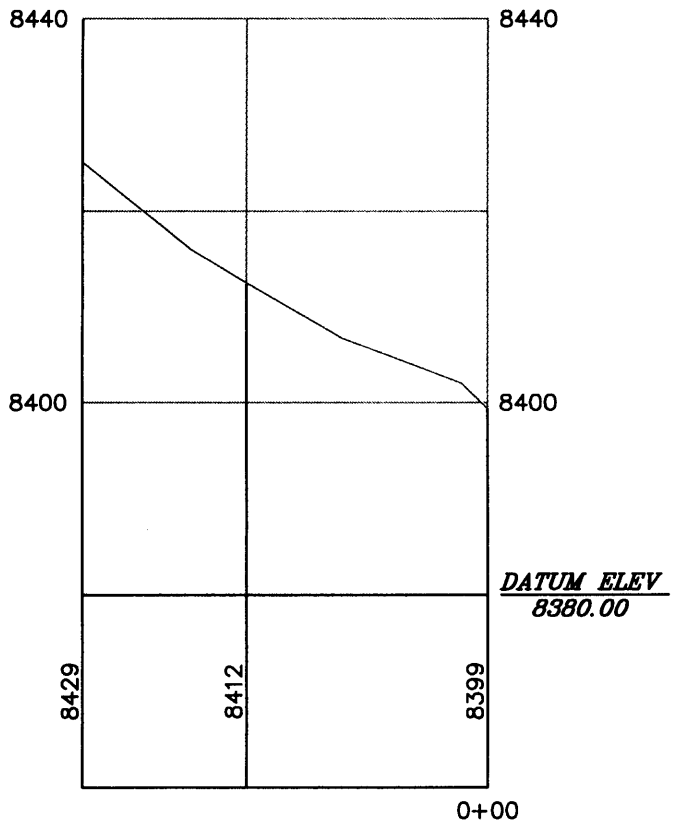
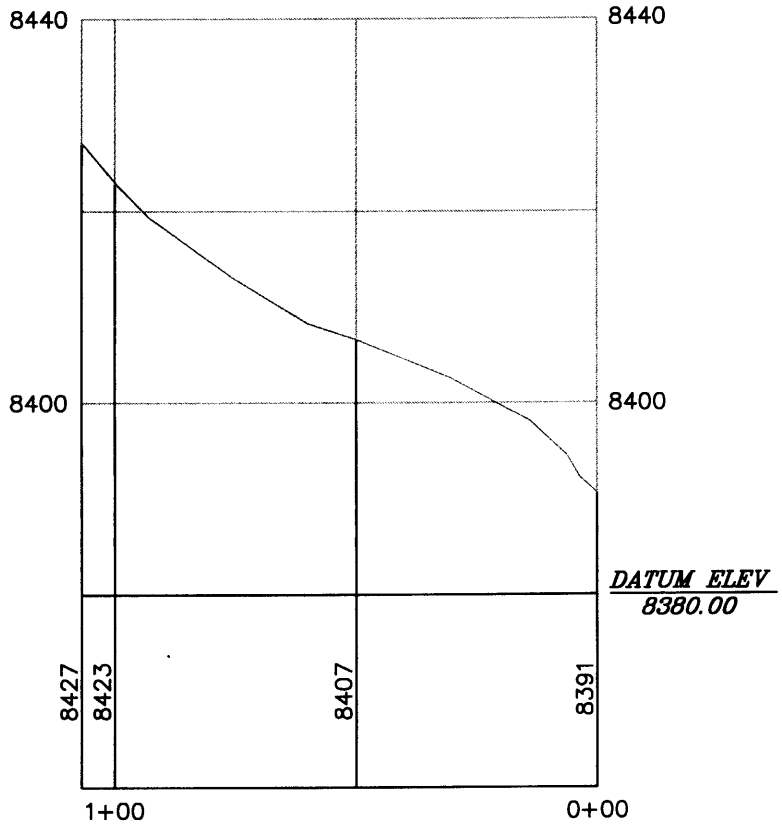


PROFILE SPRD-2

HORIZONTAL SCALE: 1=40'
VERTICAL SCALE: 1=20'



PROFILE SPRD-3

HORIZONTAL SCALE: 1=40'
VERTICAL SCALE: 1=20'

FIGURE 2. AS-BUILT RECLAMATION CHANNEL PROFILES

EarthFax

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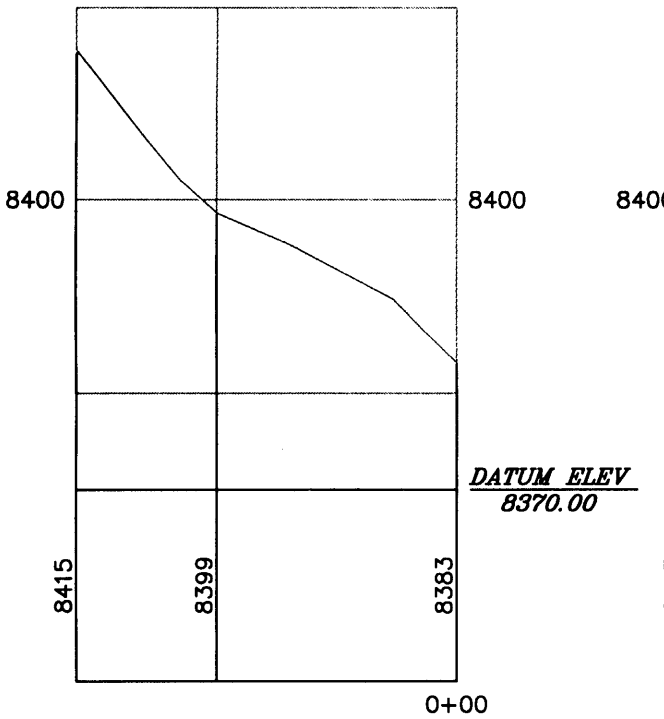
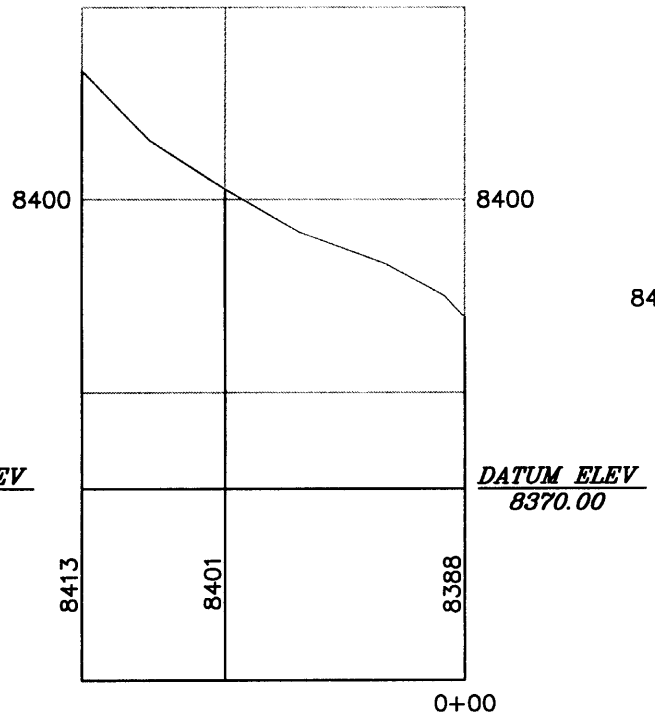


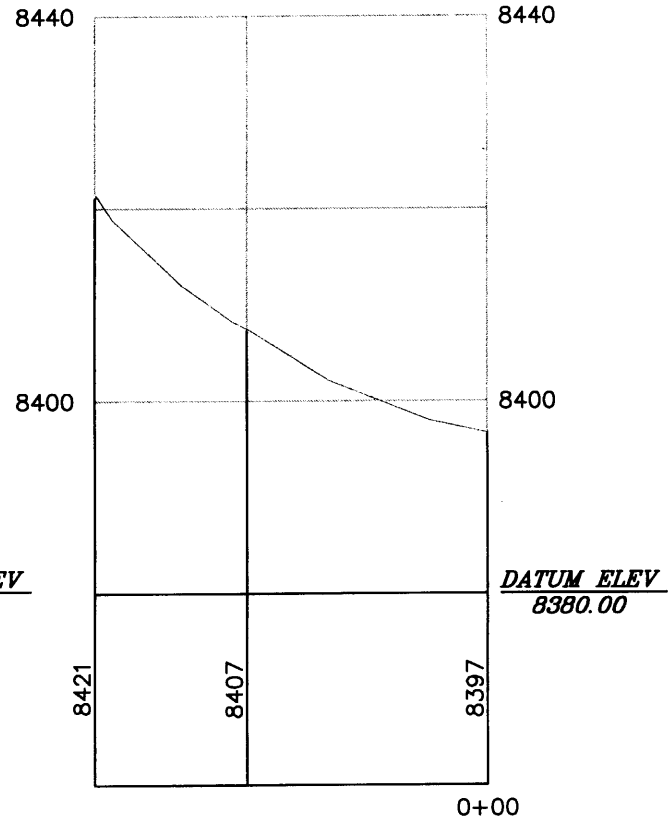
PROFILE SPRD-4a

HORIZONTAL SCALE: 1=40'
VERTICAL SCALE: 1=20'



PROFILE SPRD-4b

HORIZONTAL SCALE: 1=40'
VERTICAL SCALE: 1=20'

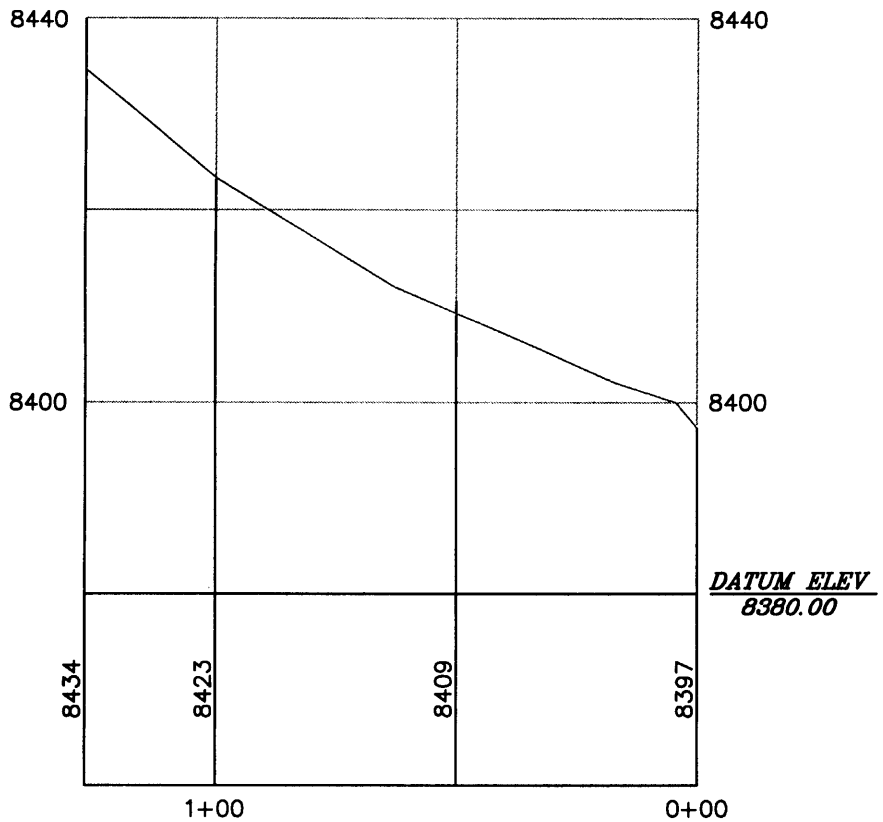


PROFILE SPRD-5

HORIZONTAL SCALE: 1=40'
VERTICAL SCALE: 1=20'

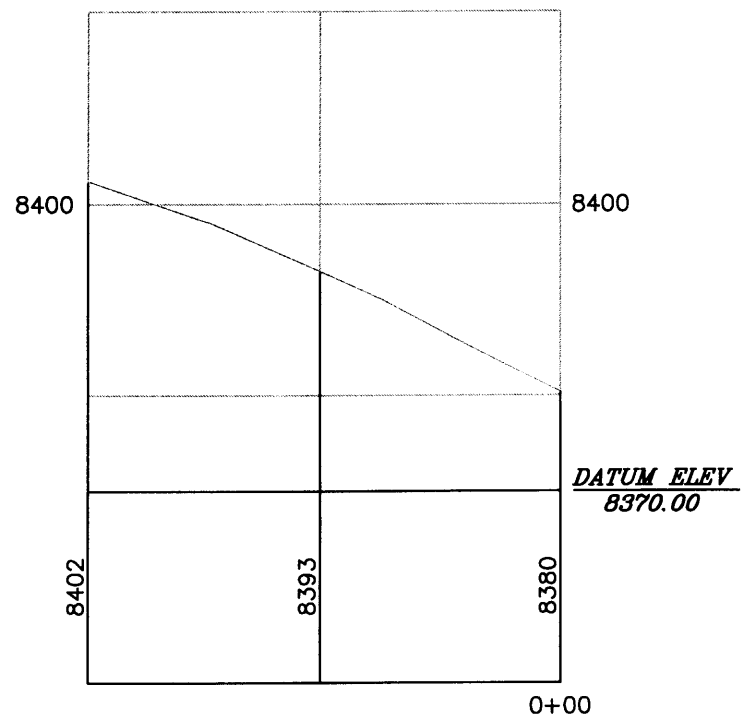
FIGURE 3. AS-BUILT RECLAMATION CHANNEL PROFILES

EarthFax



PROFILE SPRD-6

HORIZONTAL SCALE: 1=40'
VERTICAL SCALE: 1=20'

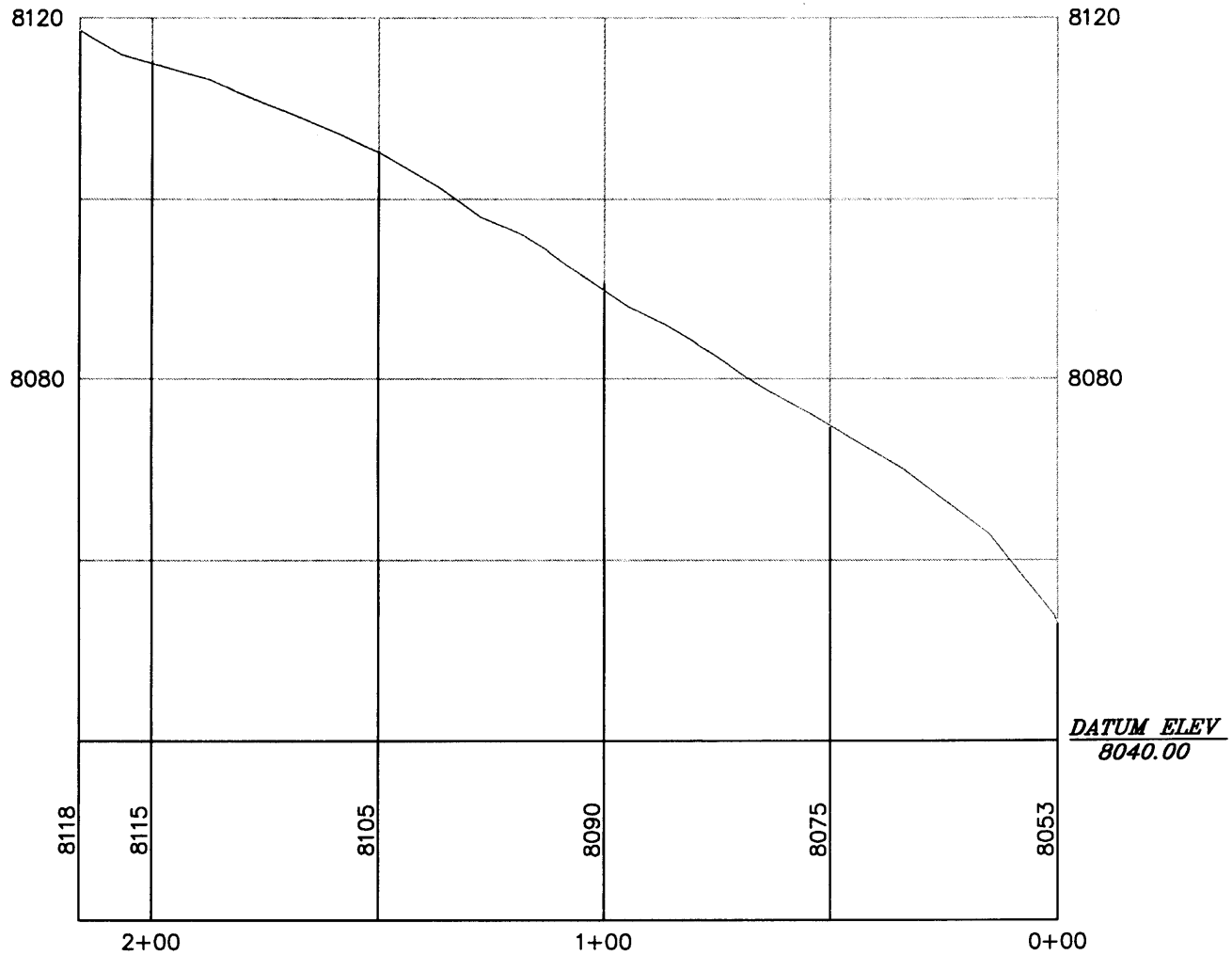


PROFILE SPRD-7

HORIZONTAL SCALE: 1=40'
VERTICAL SCALE: 1=20'

FIGURE 4. AS-BUILT RECLAMATION CHANNEL PROFILES

EarthFax

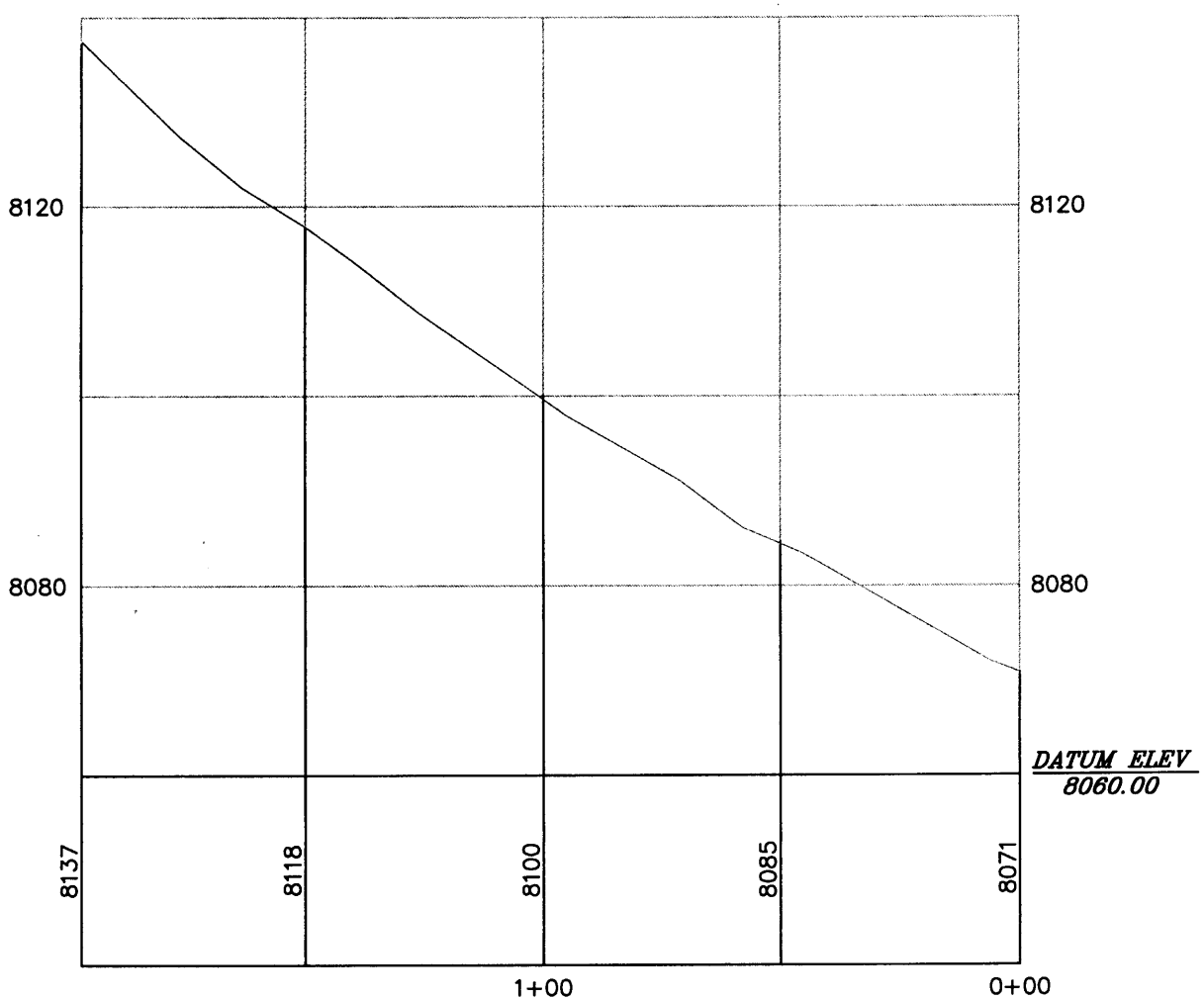


PROFILE SPRD-8

HORIZONTAL SCALE: 1=40'
VERTICAL SCALE: 1=20'

FIGURE 5. AS-BUILT RECLAMATION CHANNEL PROFILES

EarthFax

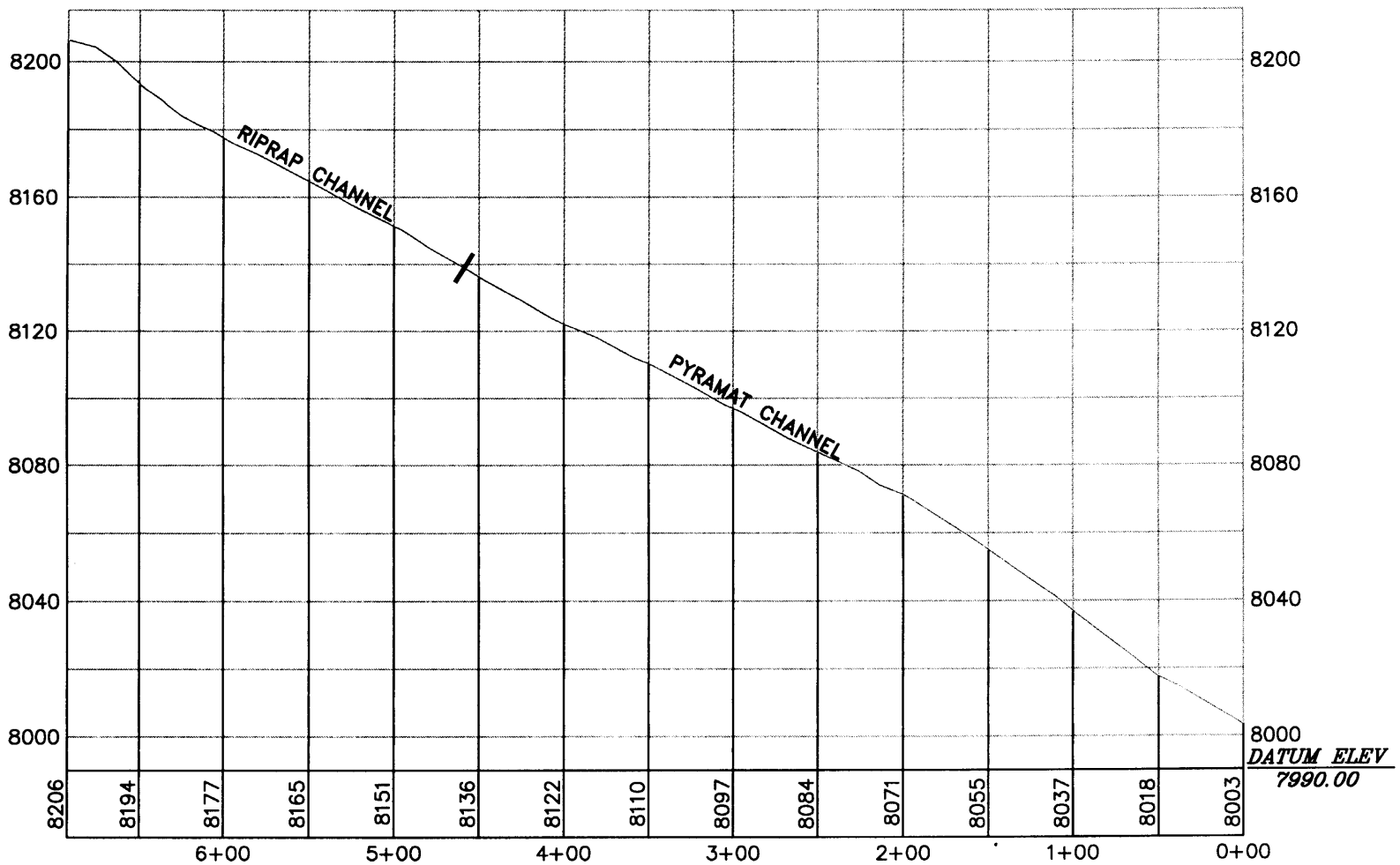


PROFILE SPRD-9

HORIZONTAL SCALE: 1=40'
VERTICAL SCALE: 1=20'

FIGURE 6. AS-BUILT RECLAMATION CHANNEL PROFILES

EarthFax



PROFILE SPRD-10

HORIZONTAL SCALE: 1=100'
VERTICAL SCALE: 1=50'

FIGURE 7. AS-BUILT RECLAMATION CHANNEL PROFILES

EarthFax

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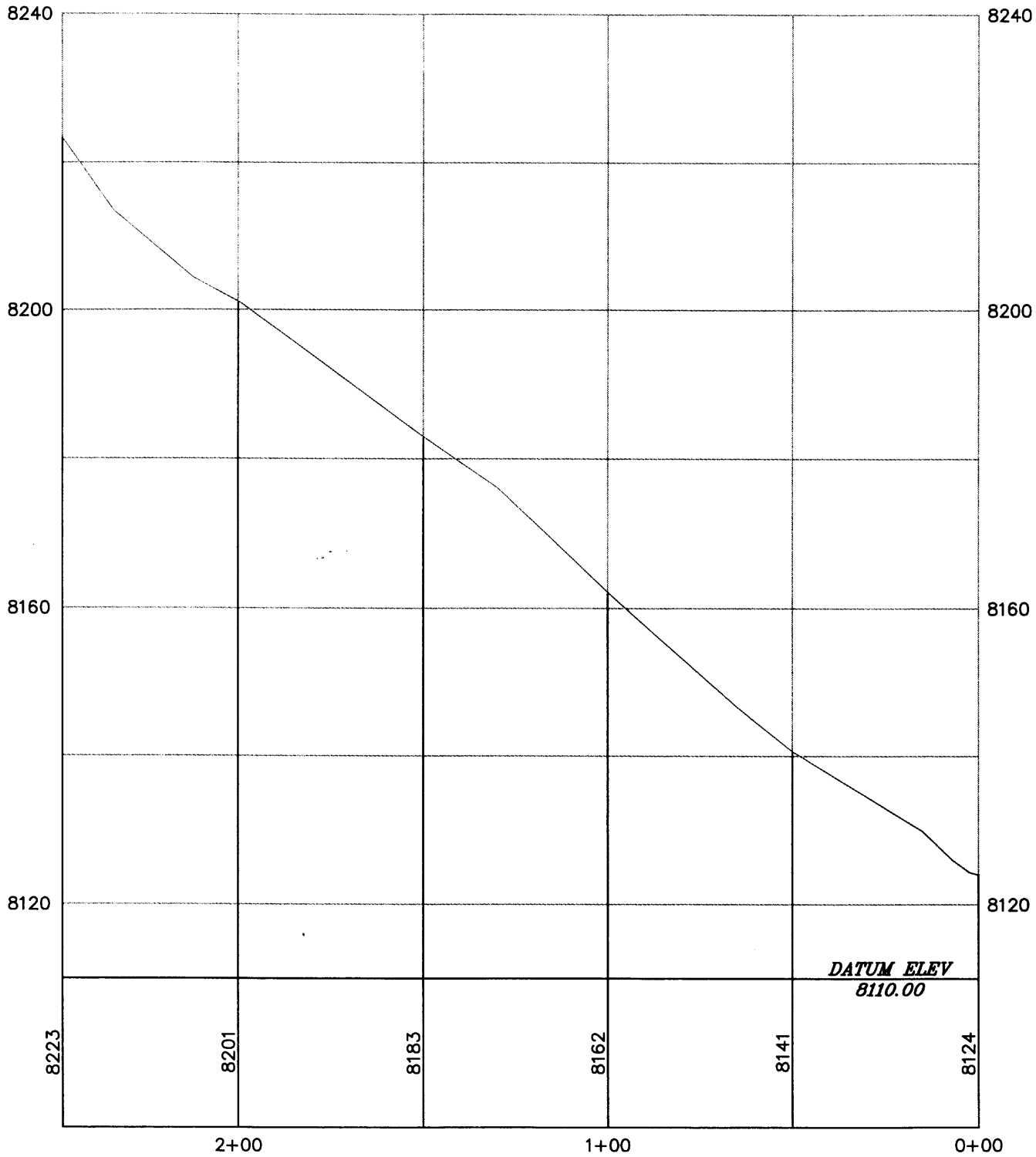
G:\UC779\07\DWG\PRO-2.DWG\10-09-03

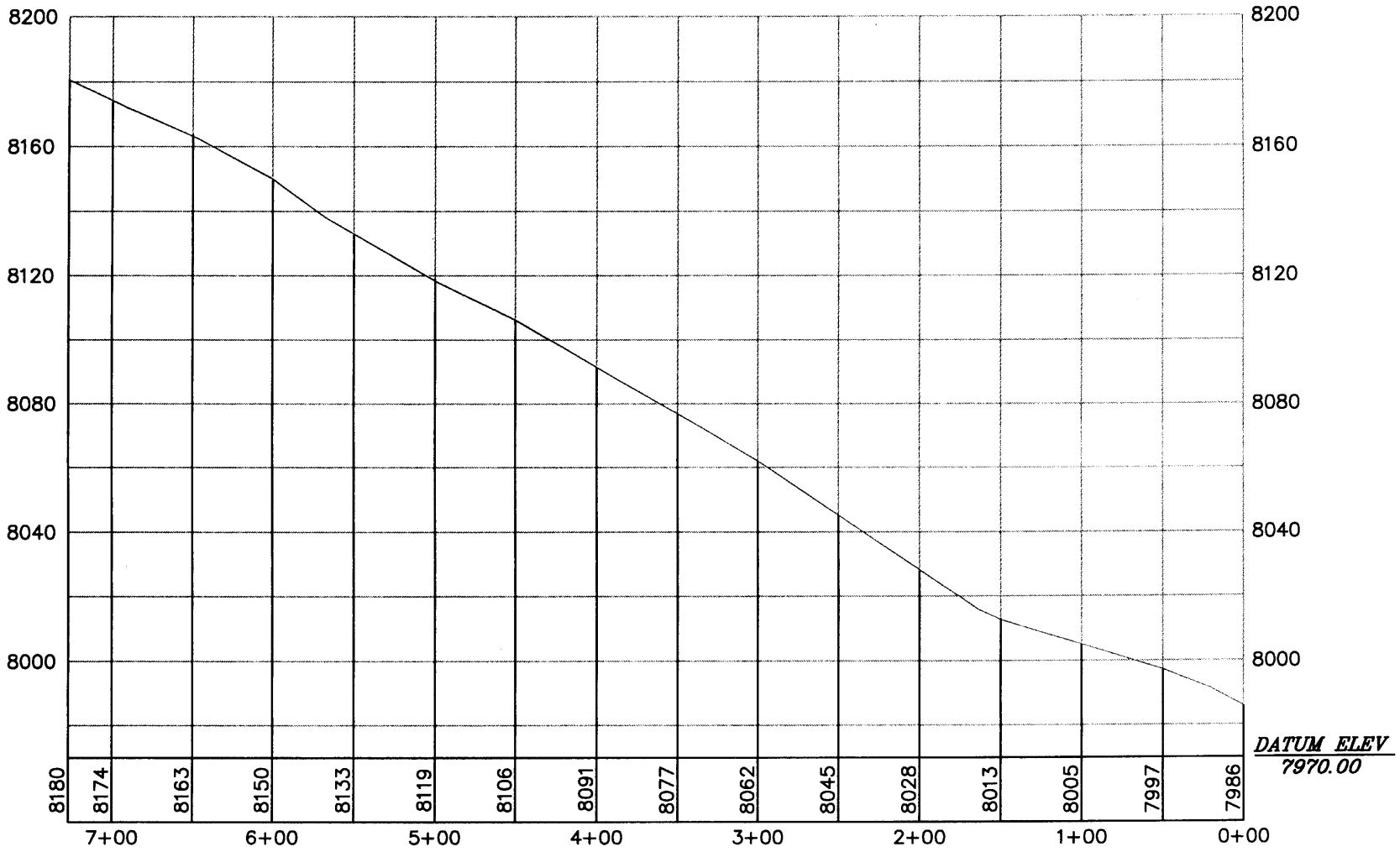


PROFILE SPRD-11

HORIZONTAL SCALE: 1=40'
VERTICAL SCALE: 1=20'

FIGURE 8. AS-BUILT RECLAMATION CHANNEL PROFILES

EarthFax

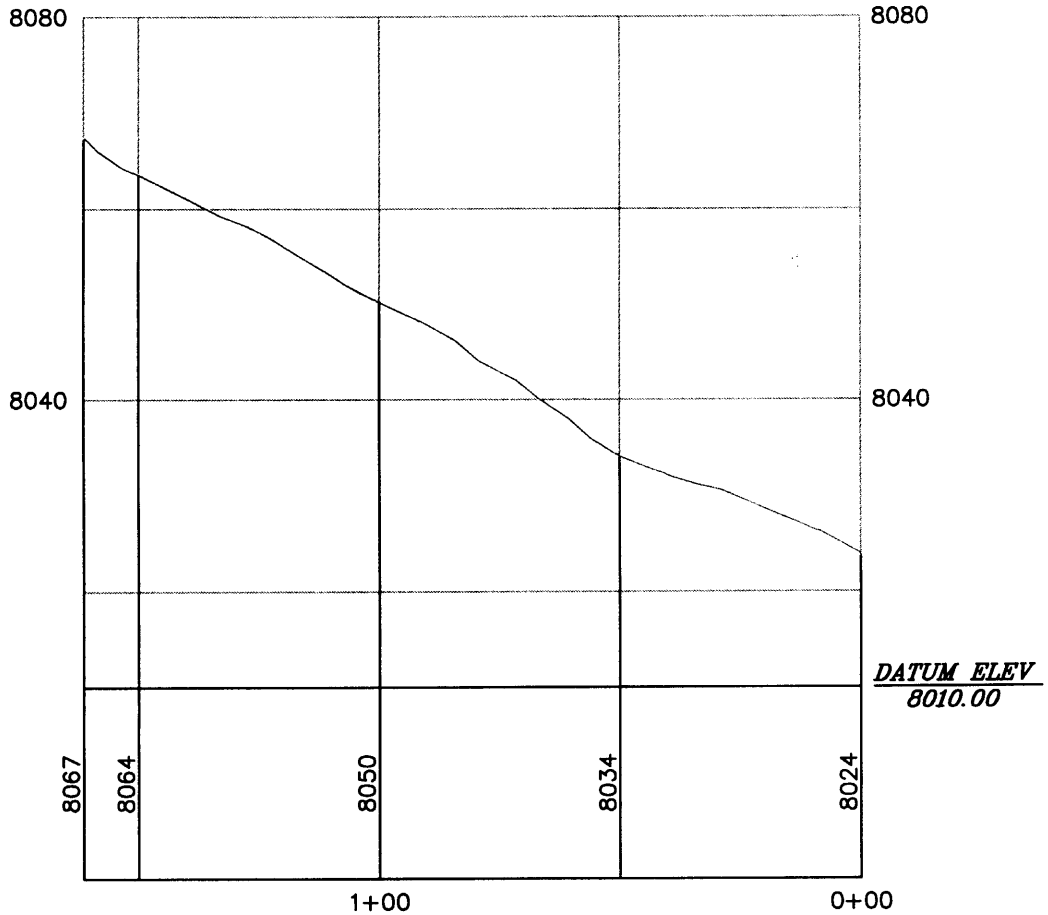


PROFILE SPRD-12

HORIZONTAL SCALE: 1=100'
VERTICAL SCALE: 1=50'

FIGURE 9. AS-BUILT RECLAMATION CHANNEL PROFILES

EarthFax



PROFILE SPRD-14

HORIZONTAL SCALE: 1=40'
VERTICAL SCALE: 1=20'

FIGURE 10. AS-BUILT RECLAMATION CHANNEL PROFILES

EarthFax

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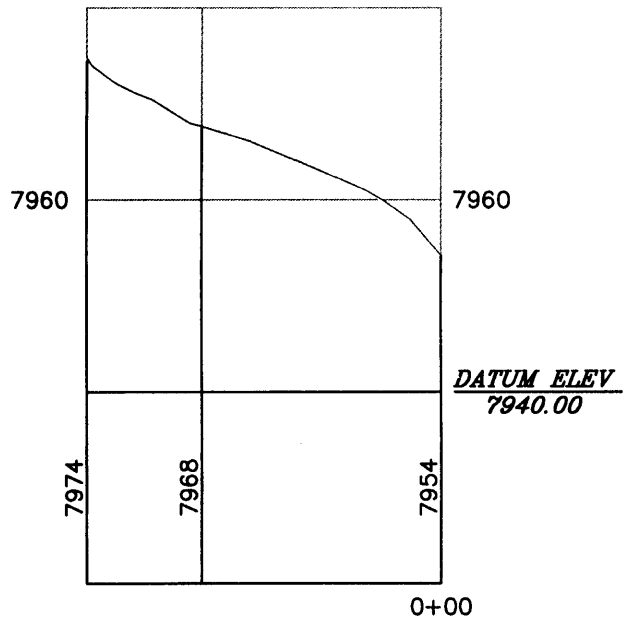
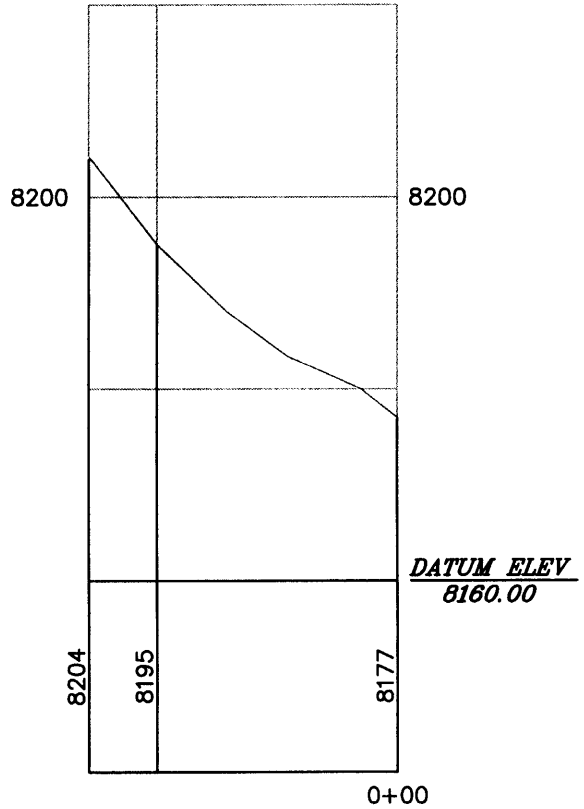


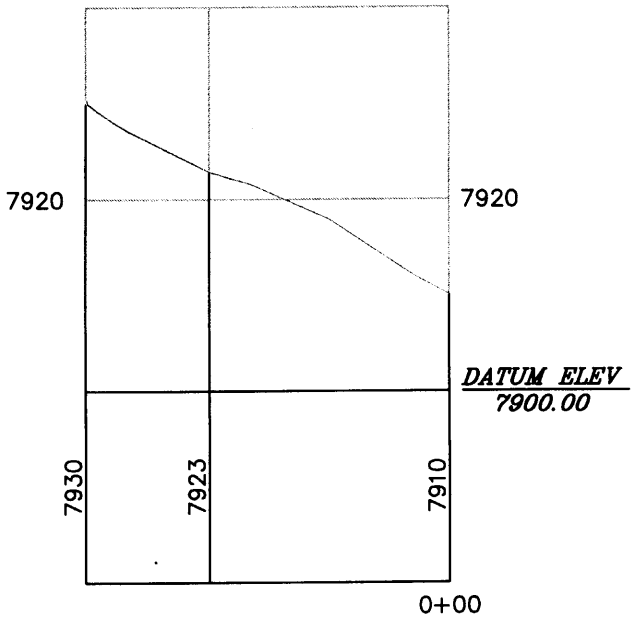
PROFILE SPRD-14a

HORIZONTAL SCALE: 1=40'
VERTICAL SCALE: 1=20'



PROFILE SPRD-15

HORIZONTAL SCALE: 1=40'
VERTICAL SCALE: 1=20'



PROFILE SPRD-16

HORIZONTAL SCALE: 1=40'
VERTICAL SCALE: 1=20'

FIGURE 11. AS-BUILT RECLAMATION CHANNEL PROFILES

EarthFax

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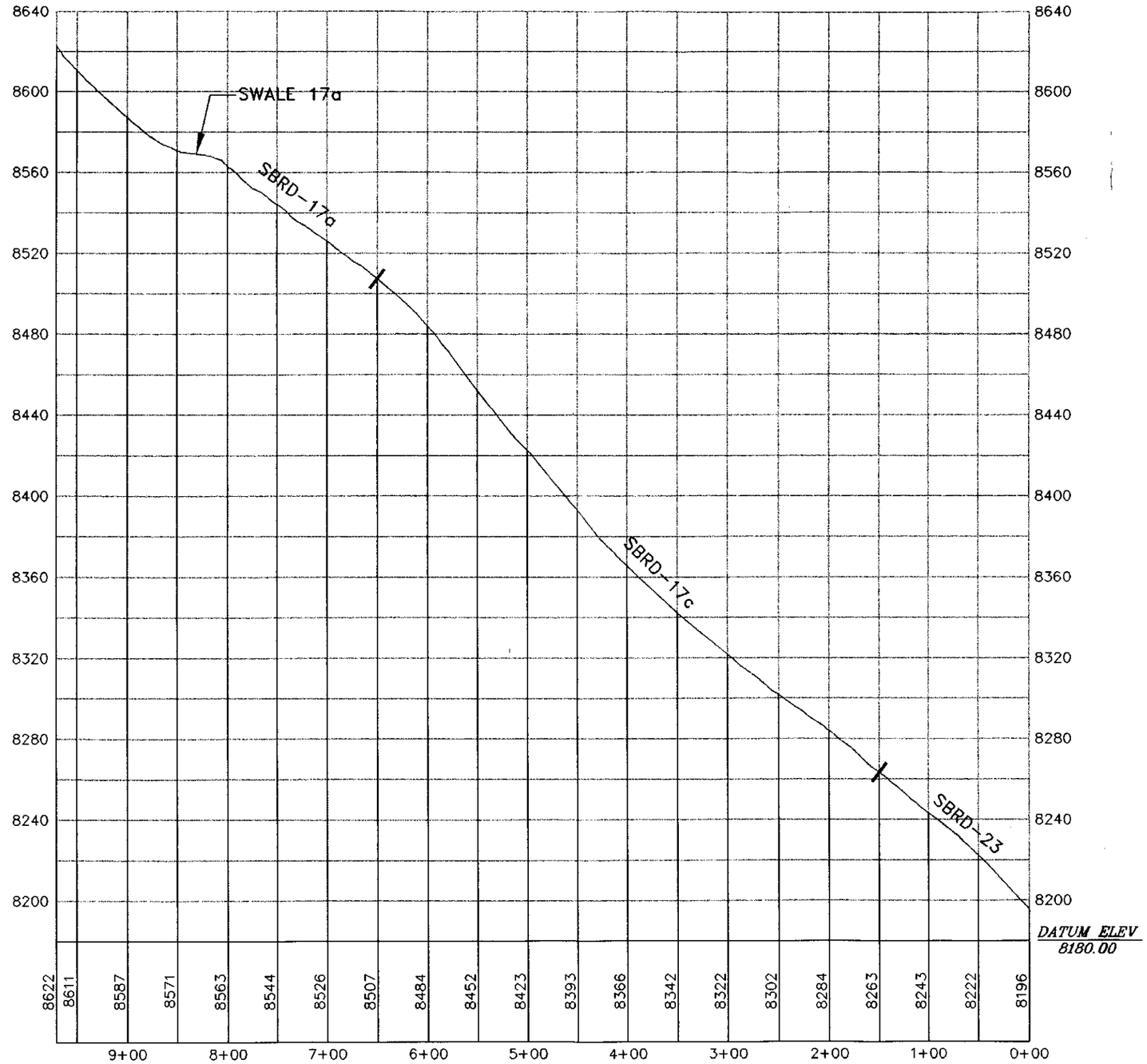
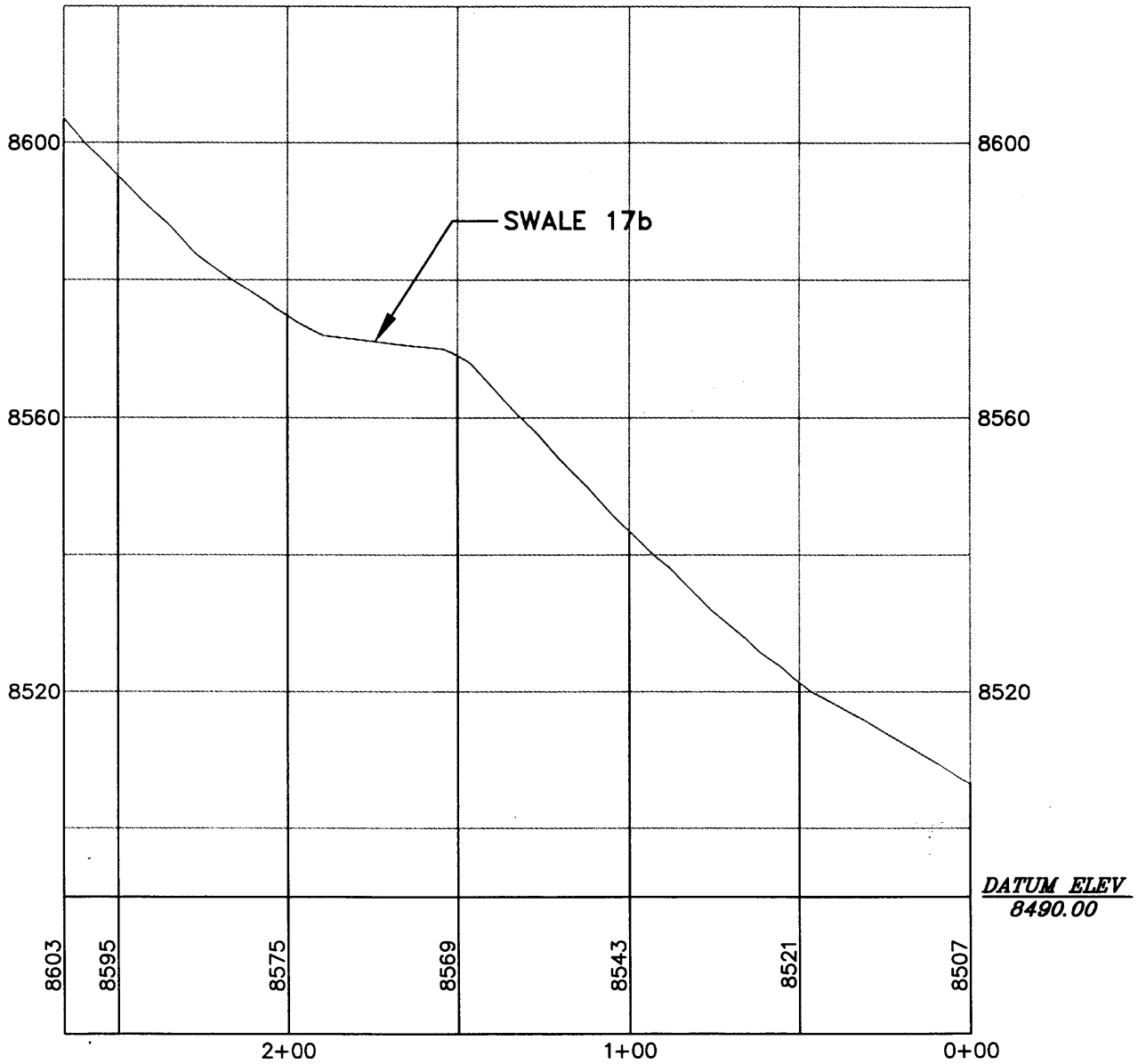


PROFILE SPRD-23,17c and 17a

HORIZONTAL SCALE: 1=120'
VERTICAL SCALE: 1=60'

FIGURE 12. AS-BUILT RECLAMATION CHANNEL PROFILES

EarthFax

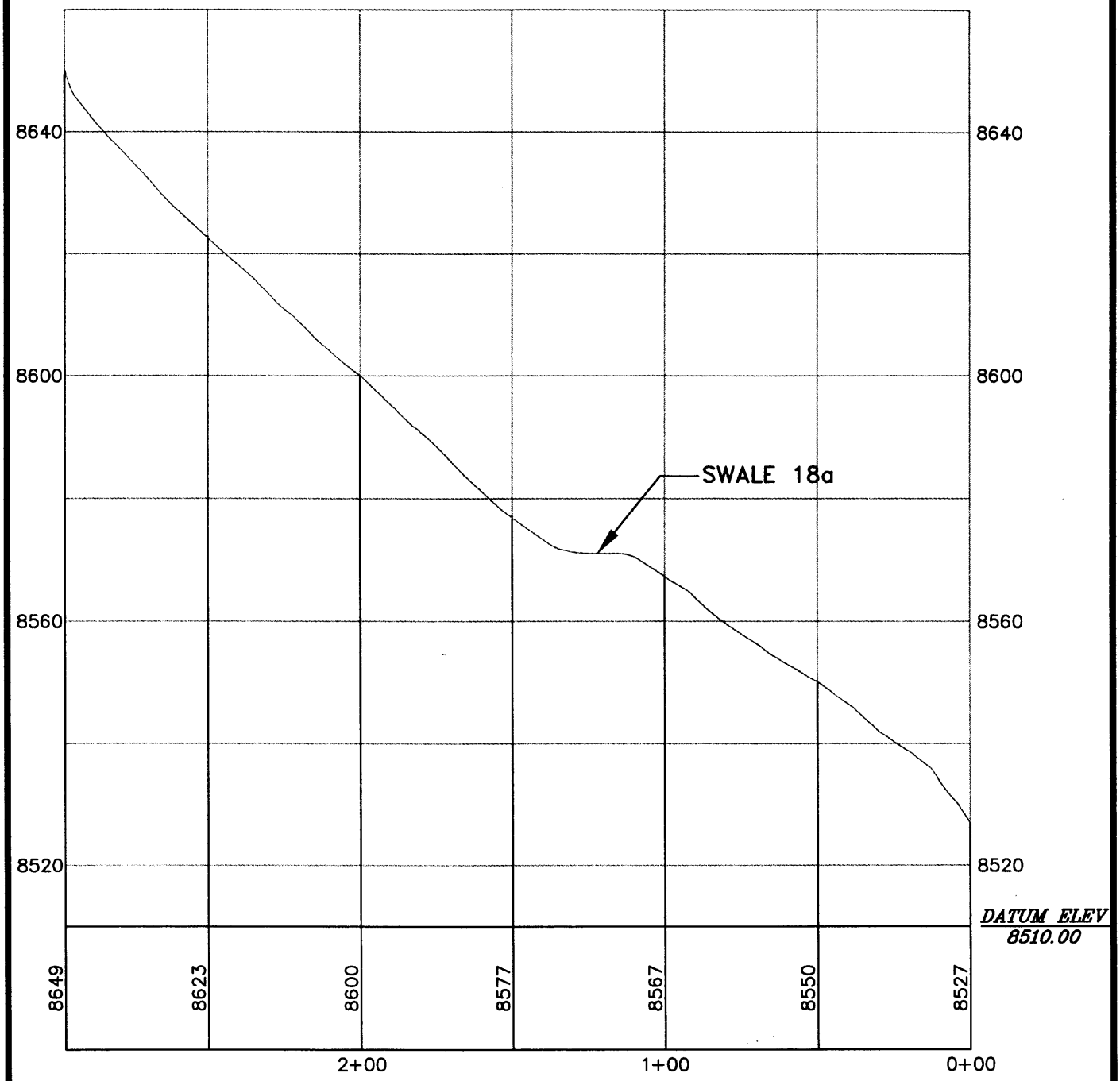


PROFILE SPRD-17b

HORIZONTAL SCALE: 1=50'
VERTICAL SCALE: 1=25'

FIGURE 13. AS-BUILT RECLAMATION CHANNEL PROFILES

EarthFax

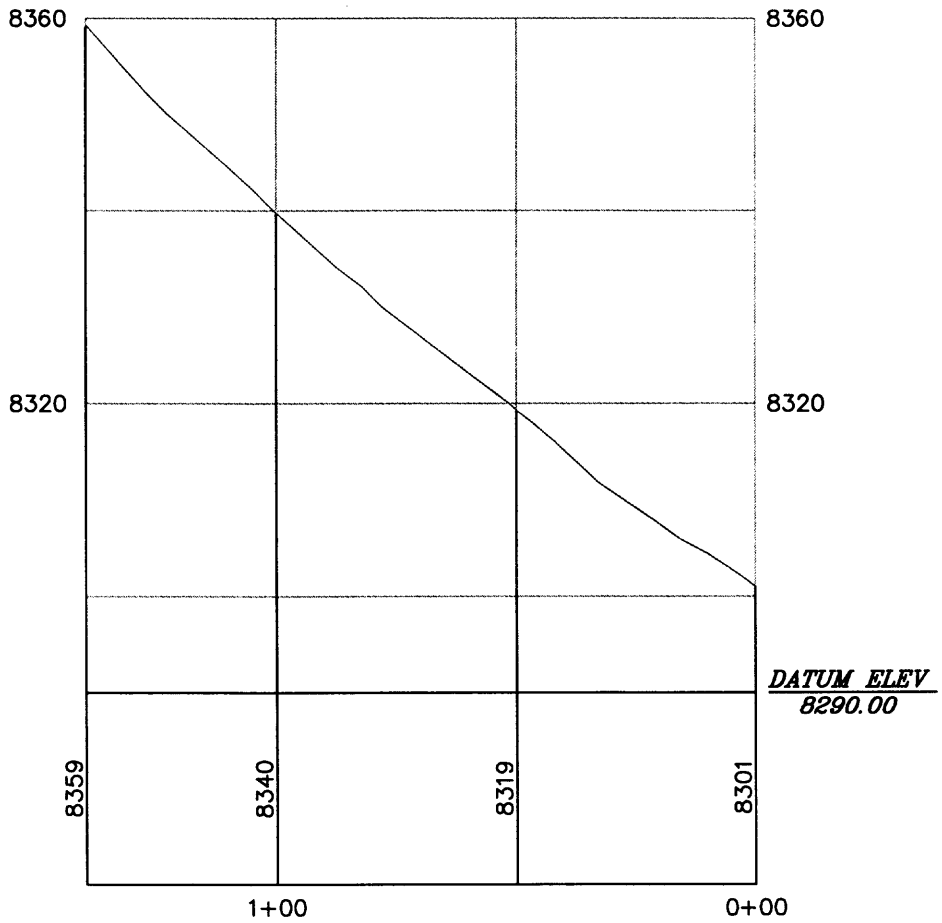


PROFILE SPRD-18a

HORIZONTAL SCALE: 1=50'
VERTICAL SCALE: 1=25'

FIGURE 14. AS-BUILT RECLAMATION CHANNEL PROFILES

EarthFax

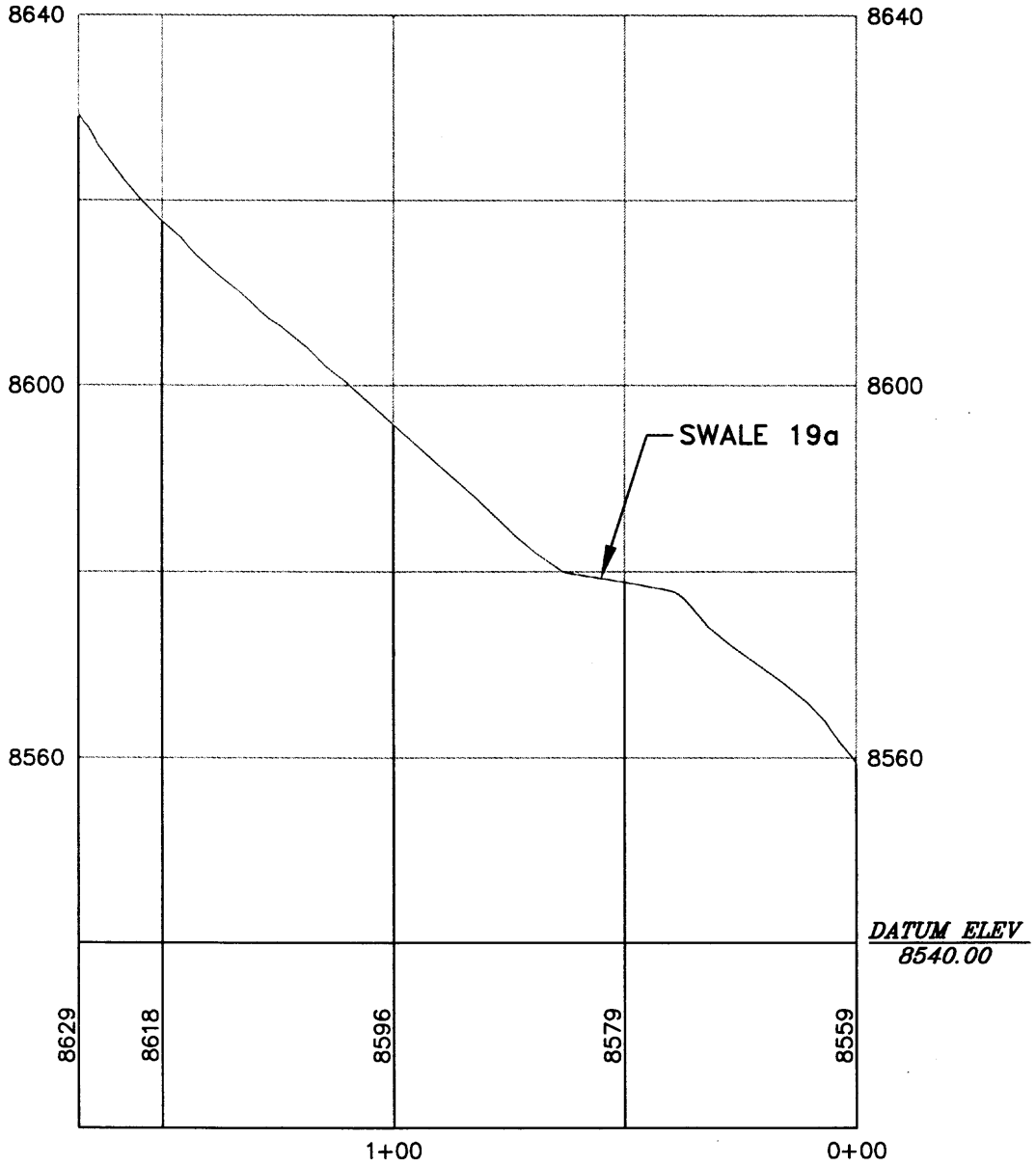


PROFILE SPRD-18b

HORIZONTAL SCALE: 1=40'
VERTICAL SCALE: 1=20'

FIGURE 15. AS-BUILT RECLAMATION CHANNEL PROFILES

EarthFax

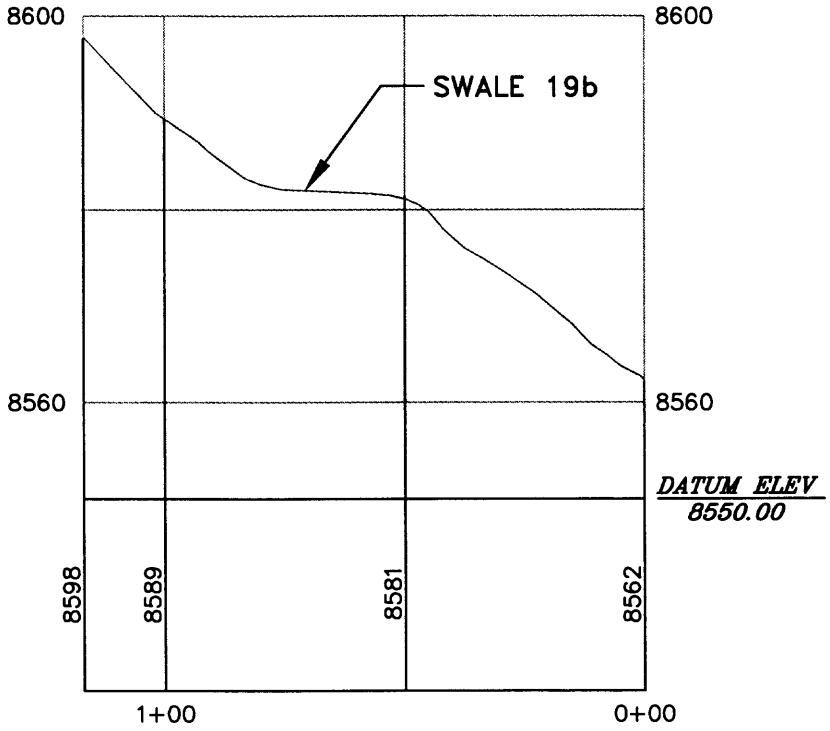


PROFILE SPRD-19a

HORIZONTAL SCALE: 1=40'
VERTICAL SCALE: 1=20'

FIGURE 16. AS-BUILT RECLAMATION CHANNEL PROFILES

EarthFax



PROFILE SPRD-19b

HORIZONTAL SCALE: 1=40'

VERTICAL SCALE: 1=20'

FIGURE 17. AS-BUILT RECLAMATION CHANNEL PROFILES

EarthFax

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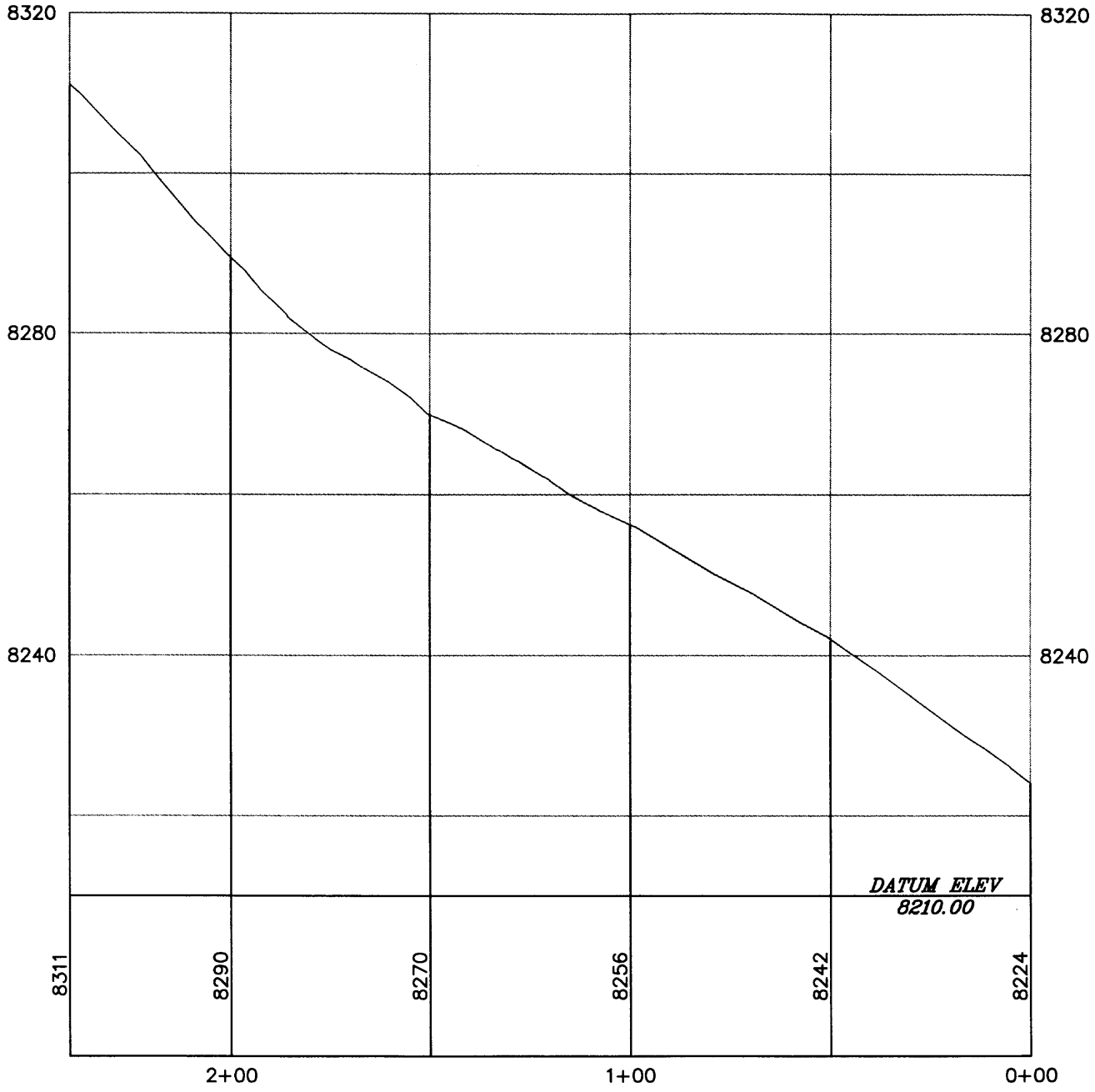
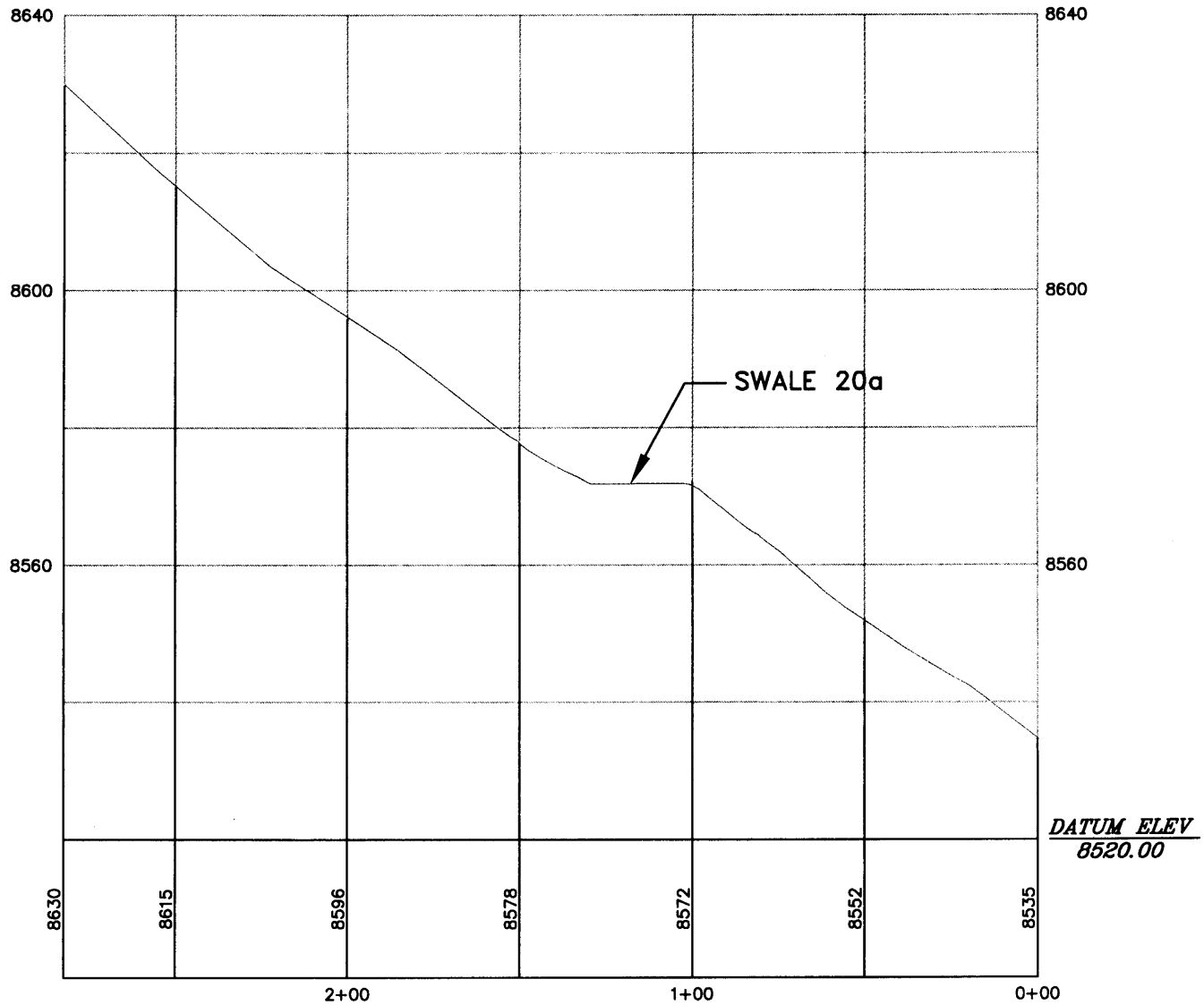


PROFILE SPRD-19c

HORIZONTAL SCALE: 1=40'
VERTICAL SCALE: 1=20'

FIGURE 18. AS-BUILT RECLAMATION CHANNEL PROFILES

EarthFax



PROFILE SPRD-20a

HORIZONTAL SCALE: 1=50'
VERTICAL SCALE: 1=25'

FIGURE 19. AS-BUILT RECLAMATION CHANNEL PROFILES

EarthFax

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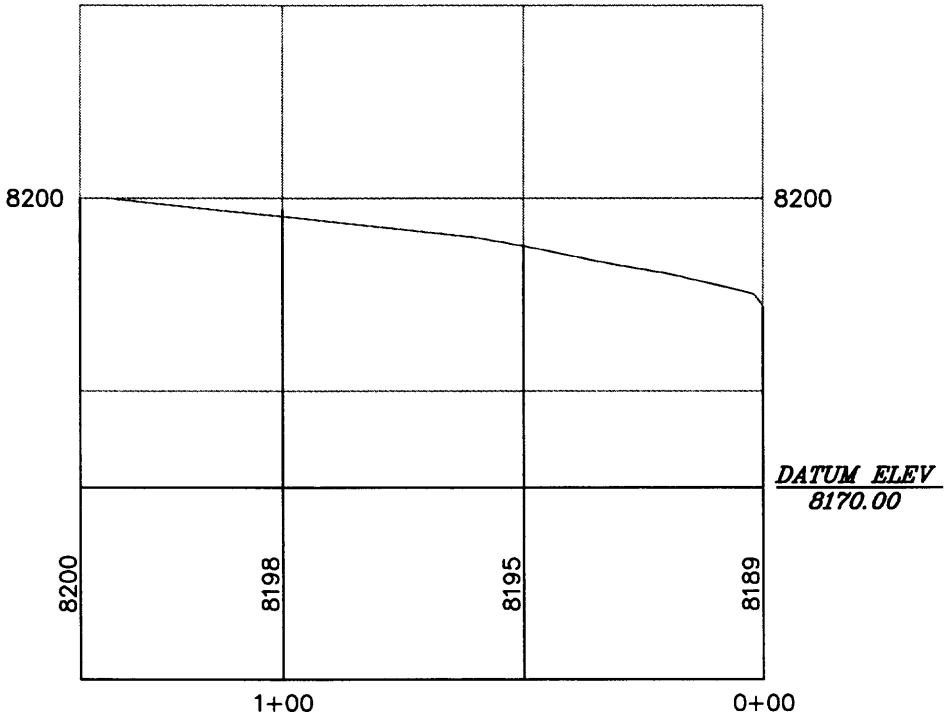

PROFILE SPRD-20b

HORIZONTAL SCALE: 1=40'
VERTICAL SCALE: 1=20'

FIGURE 20. AS-BUILT RECLAMATION CHANNEL PROFILES

EarthFax

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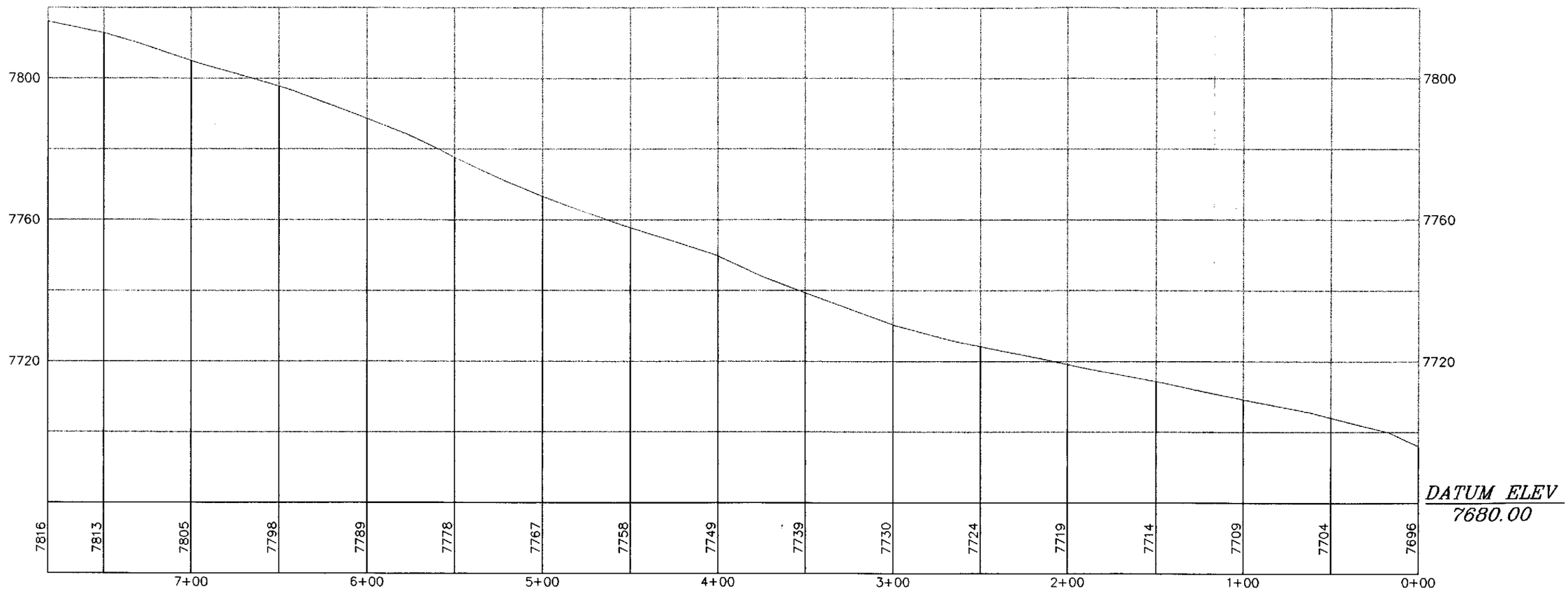
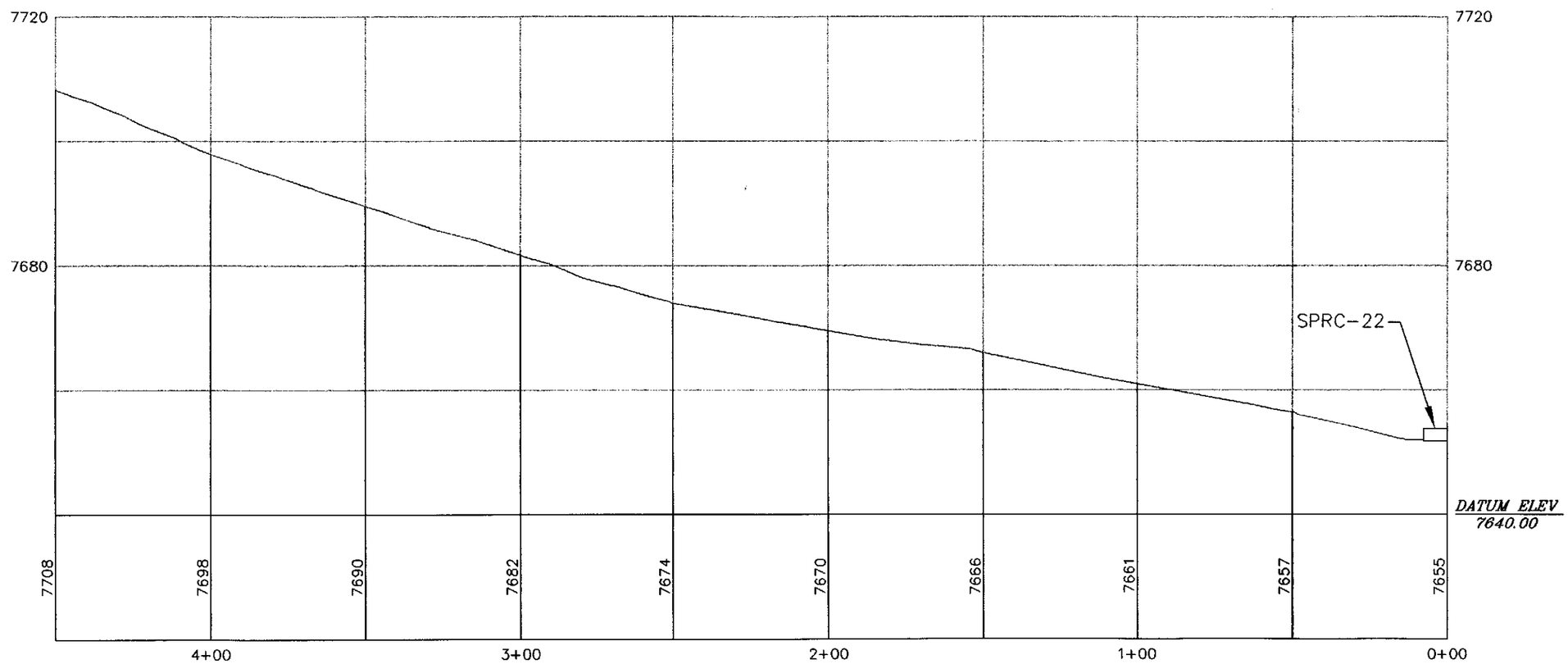


PROFILE SPRD-21

HORIZONTAL SCALE: 1=60'
VERTICAL SCALE: 1=30'

FIGURE 21. AS-BUILT RECLAMATION CHANNEL PROFILES

EarthFax

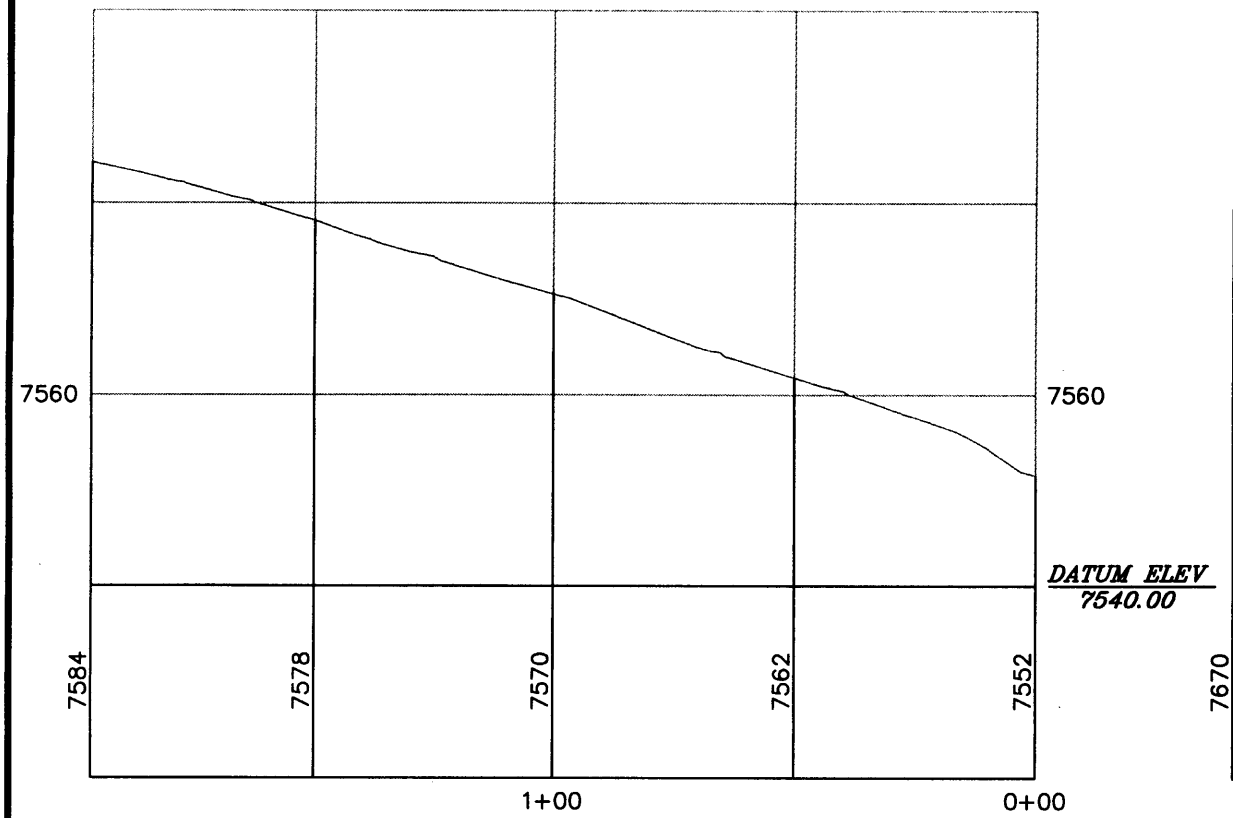


PROFILE SPRD-22a

HORIZONTAL SCALE: 1=40'
VERTICAL SCALE: 1=20'

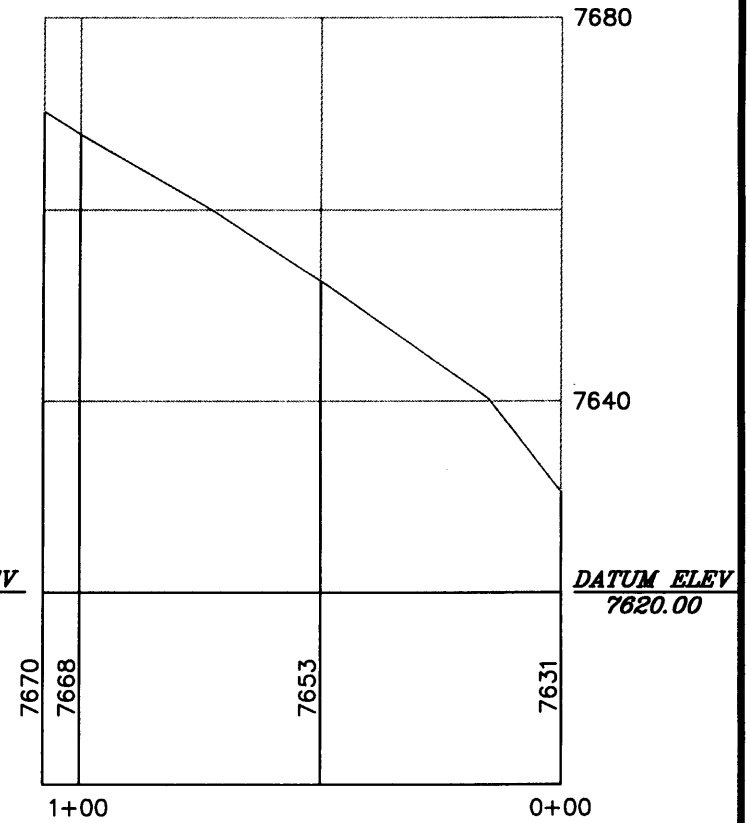
FIGURE 22. AS-BUILT RECLAMATION CHANNEL PROFILES

EarthFax



PROFILE SPRD-24

HORIZONTAL SCALE: 1=40'
VERTICAL SCALE: 1=20'



PROFILE SPRD-25a

HORIZONTAL SCALE: 1=40'
VERTICAL SCALE: 1=20'

FIGURE 23. AS-BUILT RECLAMATION CHANNEL PROFILES

EarthFax

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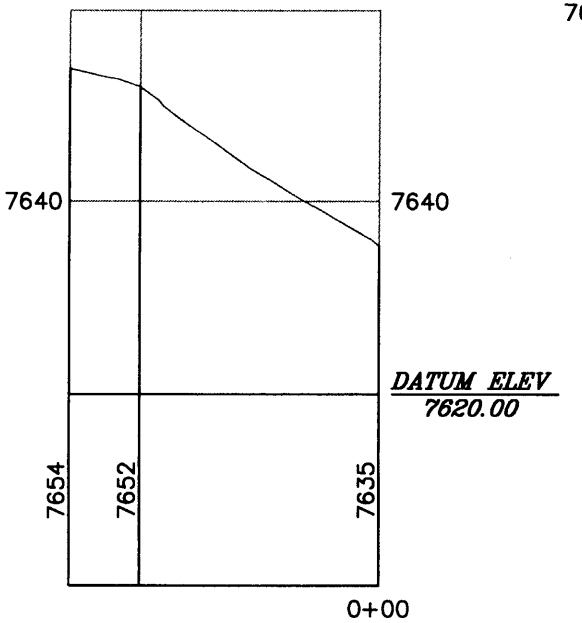
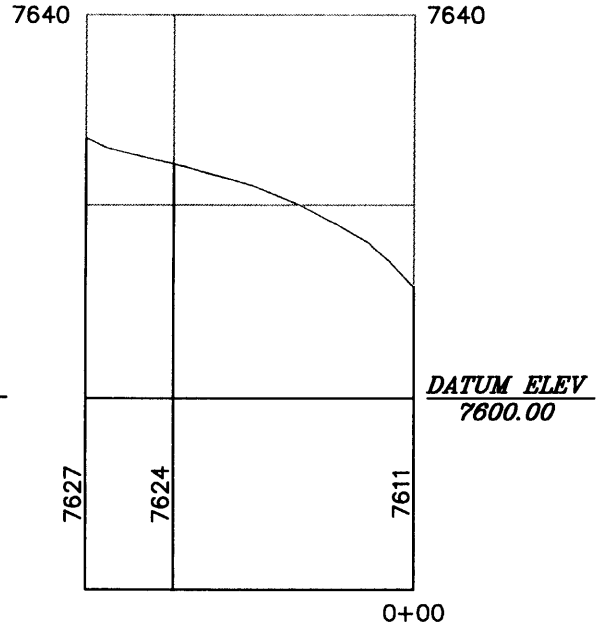


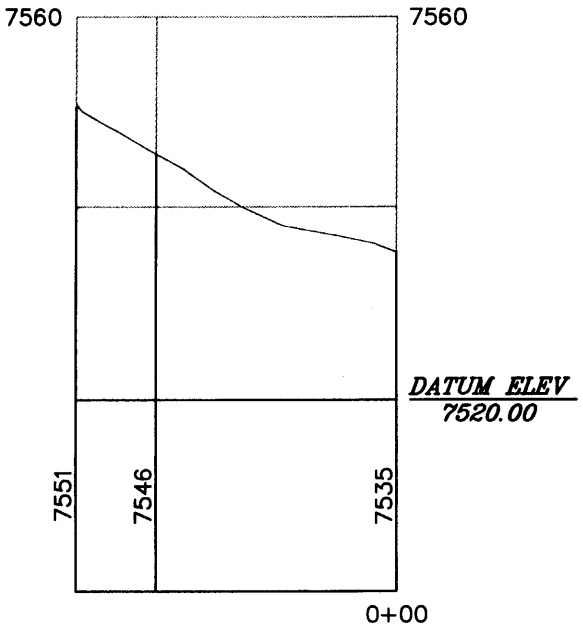
PROFILE SPRD-25b

HORIZONTAL SCALE: 1=40'
VERTICAL SCALE: 1=20'



PROFILE SPRD-26

HORIZONTAL SCALE: 1=40'
VERTICAL SCALE: 1=20'



PROFILE SBRD-26

HORIZONTAL SCALE: 1=40'
VERTICAL SCALE: 1=20'

FIGURE 24. AS-BUILT RECLAMATION CHANNEL PROFILES

EarthFax

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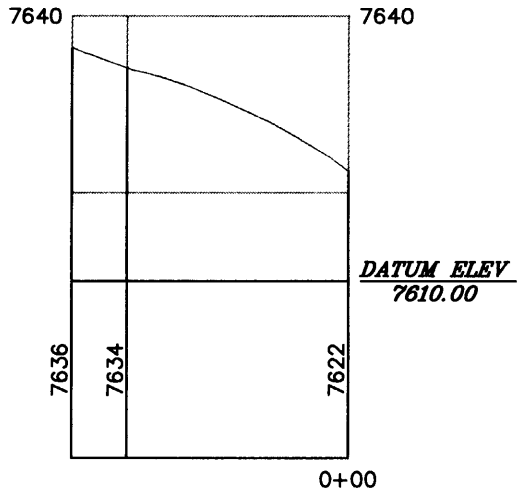
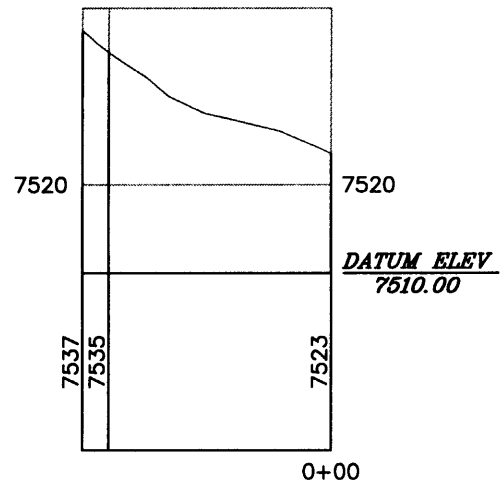


PROFILE SPRD-26a

HORIZONTAL SCALE: 1=40'
VERTICAL SCALE: 1=20'



PROFILE SBRD-27

HORIZONTAL SCALE: 1=40'
VERTICAL SCALE: 1=20'

FIGURE 25. AS-BUILT RECLAMATION CHANNEL PROFILES

EarthFax

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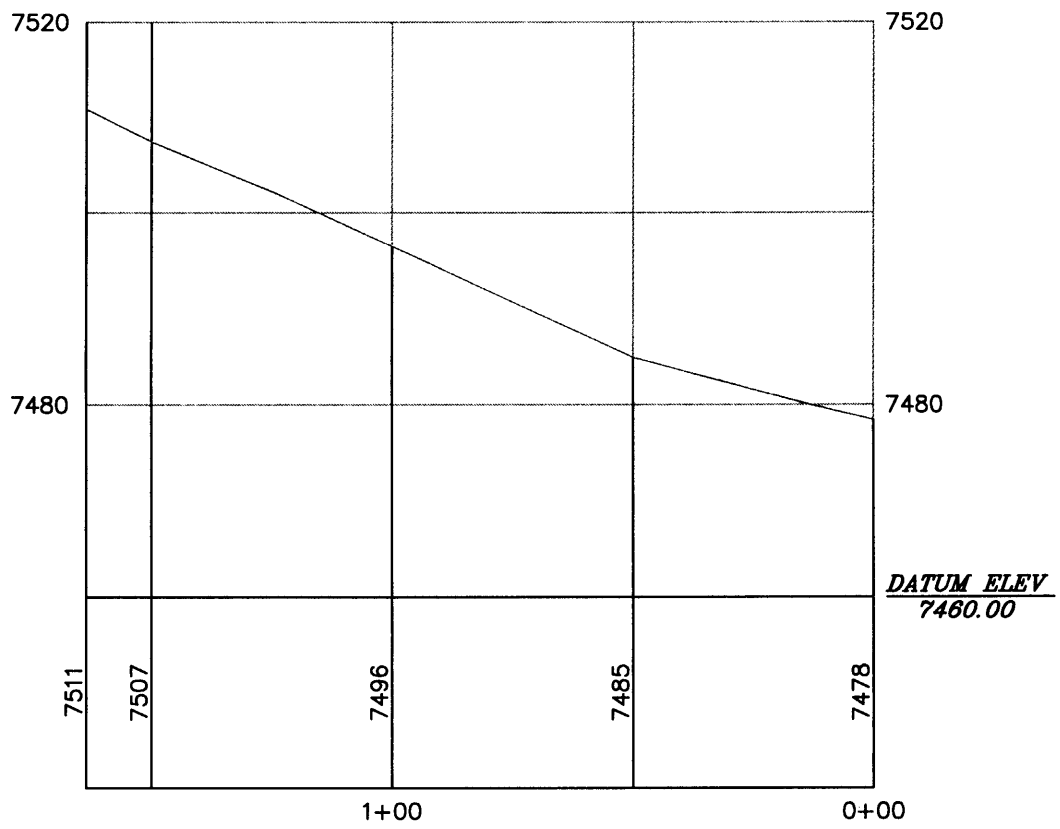

PROFILE SBRD-28

HORIZONTAL SCALE: 1=40'
VERTICAL SCALE: 1=20'

FIGURE 26. AS-BUILT RECLAMATION CHANNEL PROFILES

EarthFax

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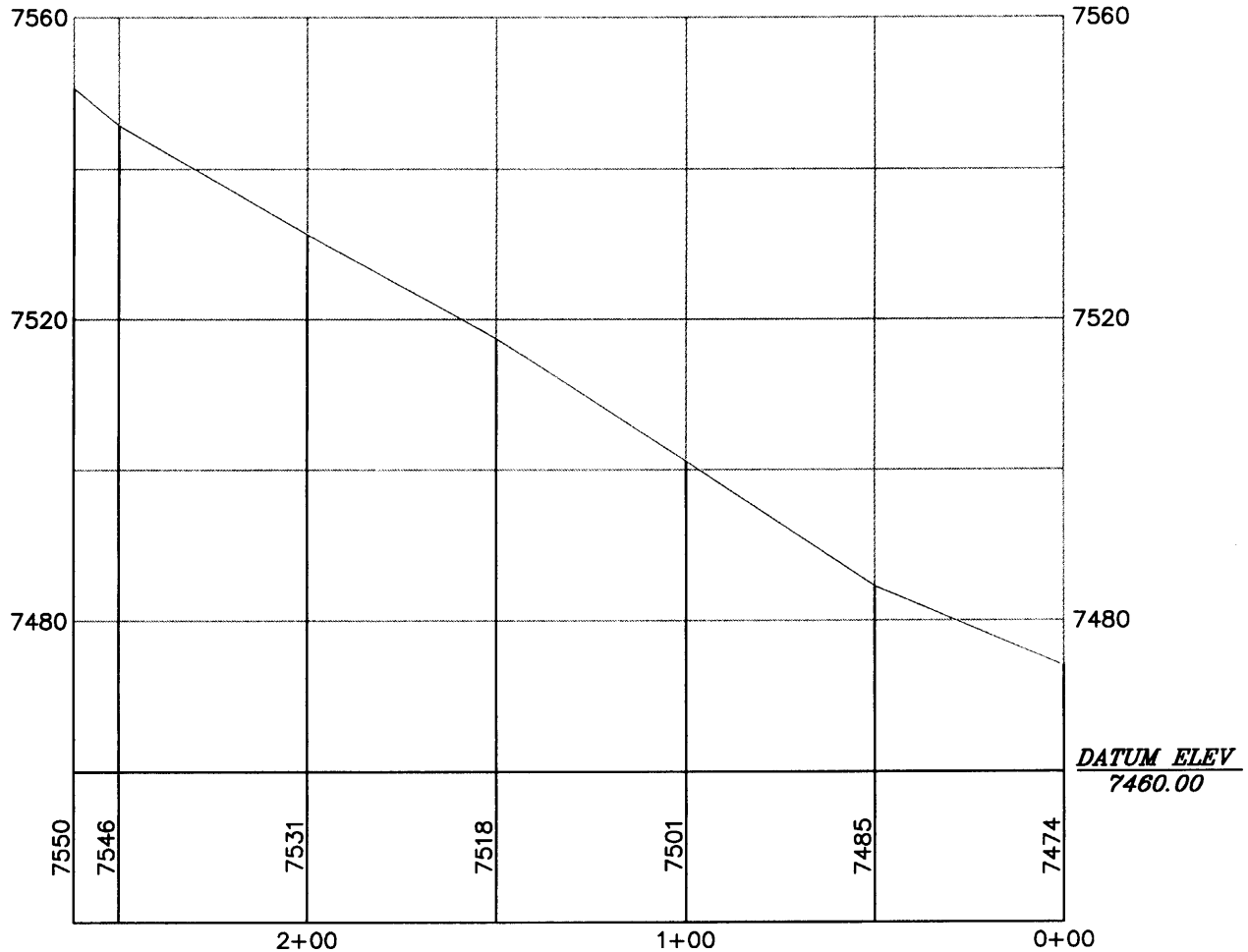

PROFILE SBRD-29a

HORIZONTAL SCALE: 1=50'
VERTICAL SCALE: 1=25'

FIGURE 27. AS-BUILT RECLAMATION CHANNEL PROFILES

EarthFax

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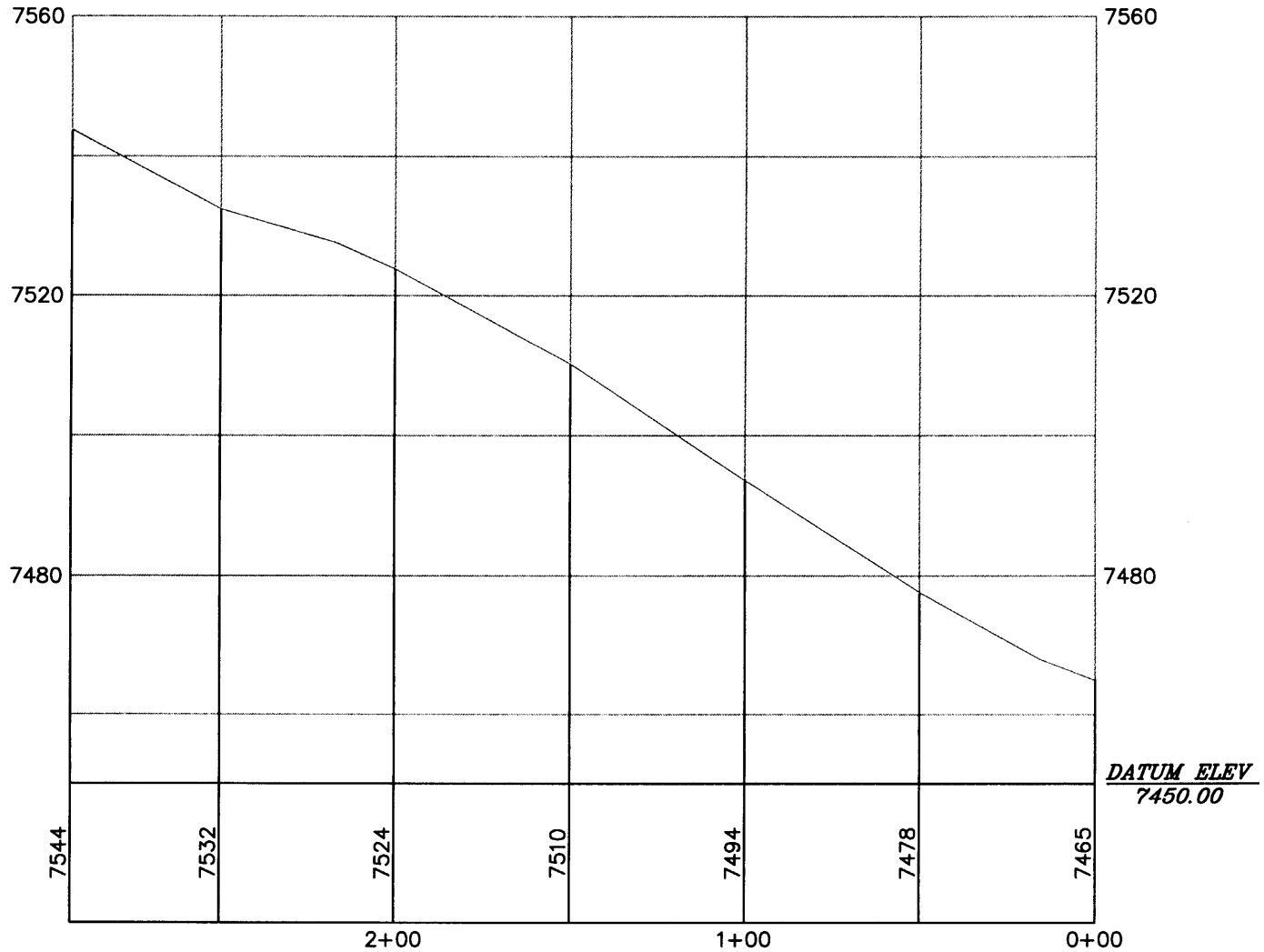

PROFILE SBRD-29b

HORIZONTAL SCALE: 1=50'
VERTICAL SCALE: 1=25'

FIGURE 28. AS-BUILT RECLAMATION CHANNEL PROFILES

EarthFax

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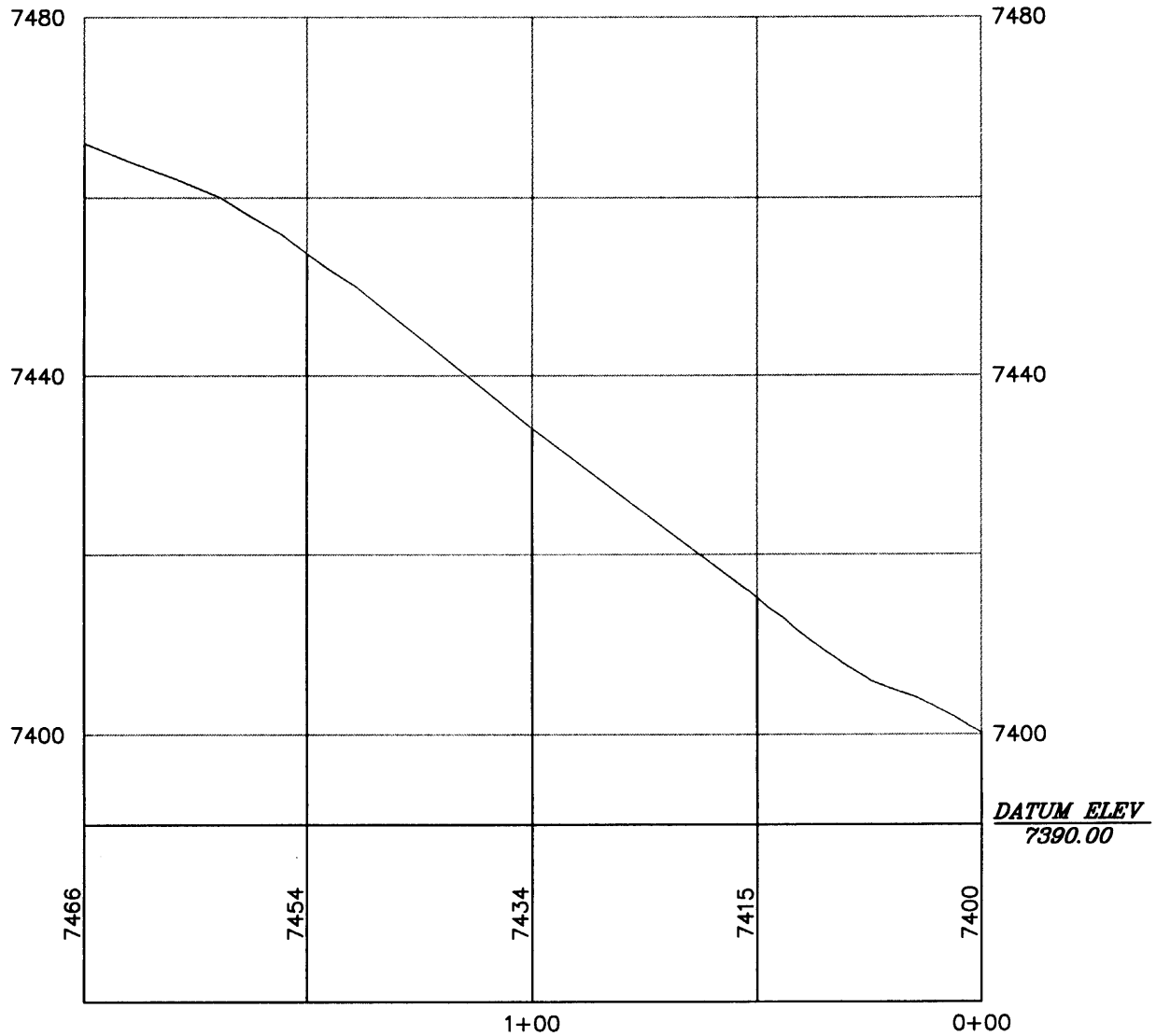

PROFILE SPRD-30

HORIZONTAL SCALE: 1=40'
VERTICAL SCALE: 1=20'

FIGURE 29. AS-BUILT RECLAMATION CHANNEL PROFILES

EarthFax

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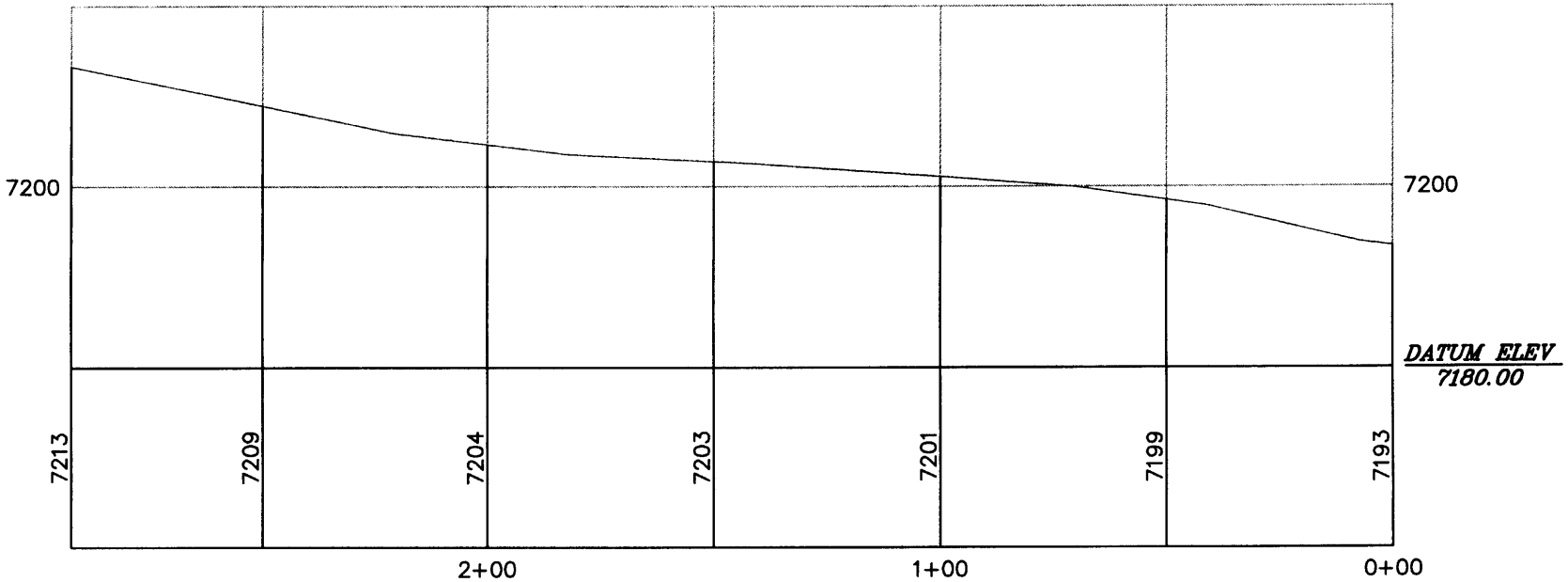

PROFILE SPRD-33

HORIZONTAL SCALE: 1=40'
VERTICAL SCALE: 1=20'

FIGURE 30. AS-BUILT RECLAMATION CHANNEL PROFILES

EarthFax

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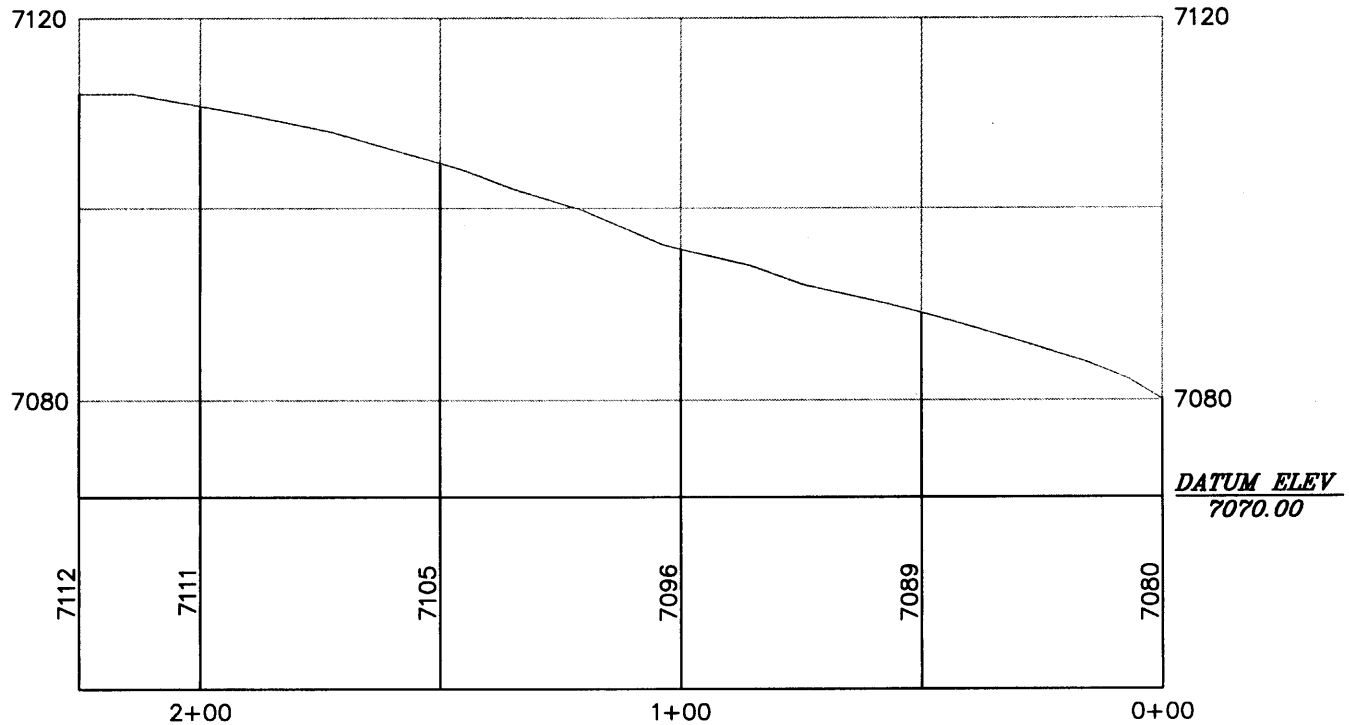

PROFILE SPRD-35

HORIZONTAL SCALE: 1=40'
VERTICAL SCALE: 1=20'

FIGURE 31. AS-BUILT RECLAMATION CHANNEL PROFILES

EarthFax

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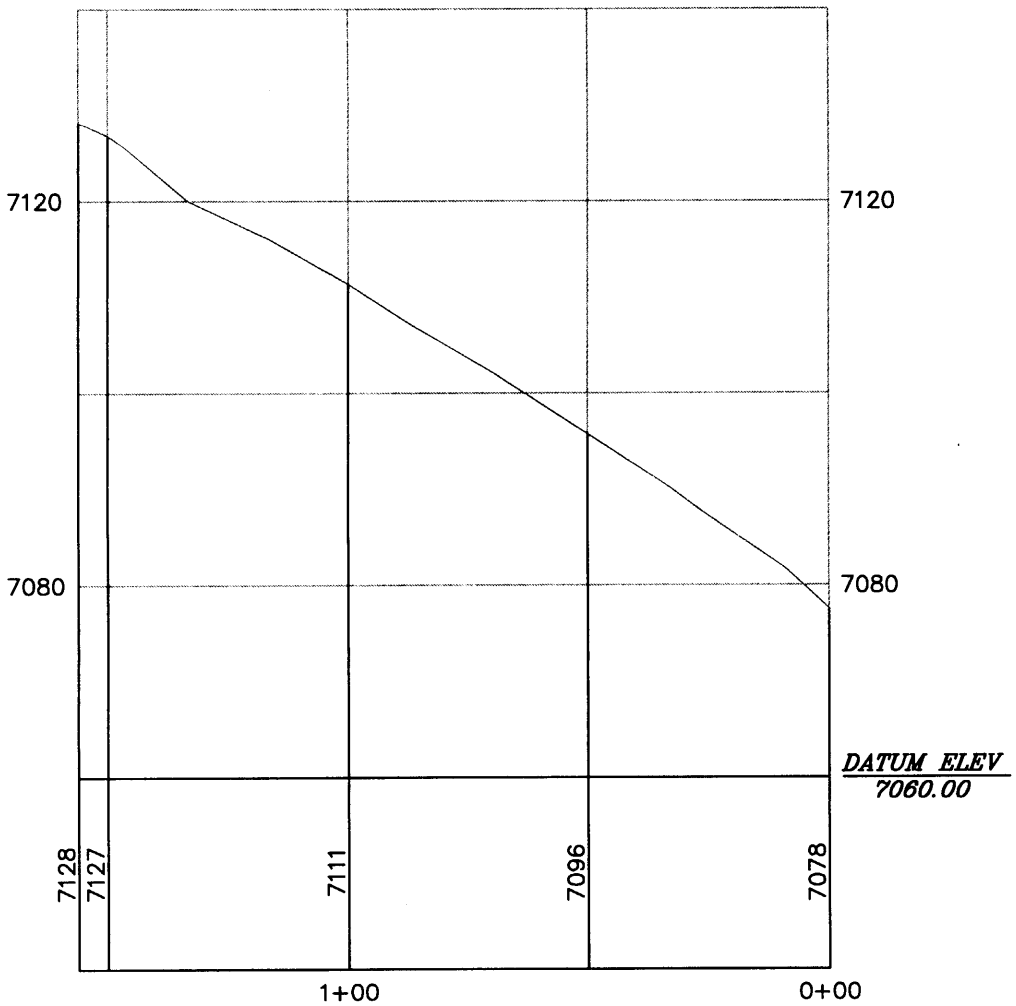
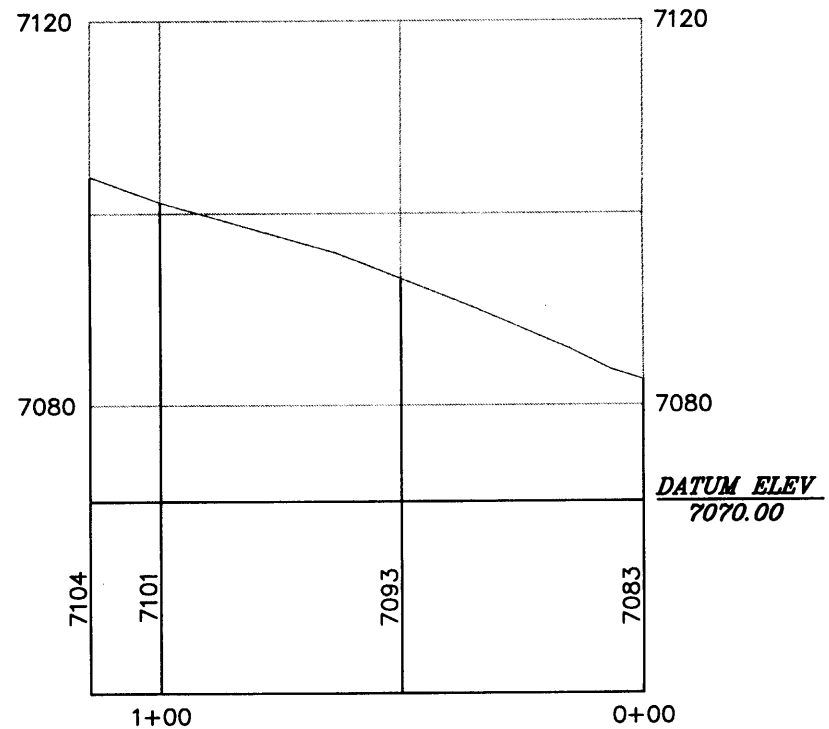


PROFILE SPRD-35a

HORIZONTAL SCALE: 1=40'
VERTICAL SCALE: 1=20'



PROFILE SPRD-36a

HORIZONTAL SCALE: 1=40'
VERTICAL SCALE: 1=20'

FIGURE 32. AS-BUILT RECLAMATION CHANNEL PROFILES

EarthFax

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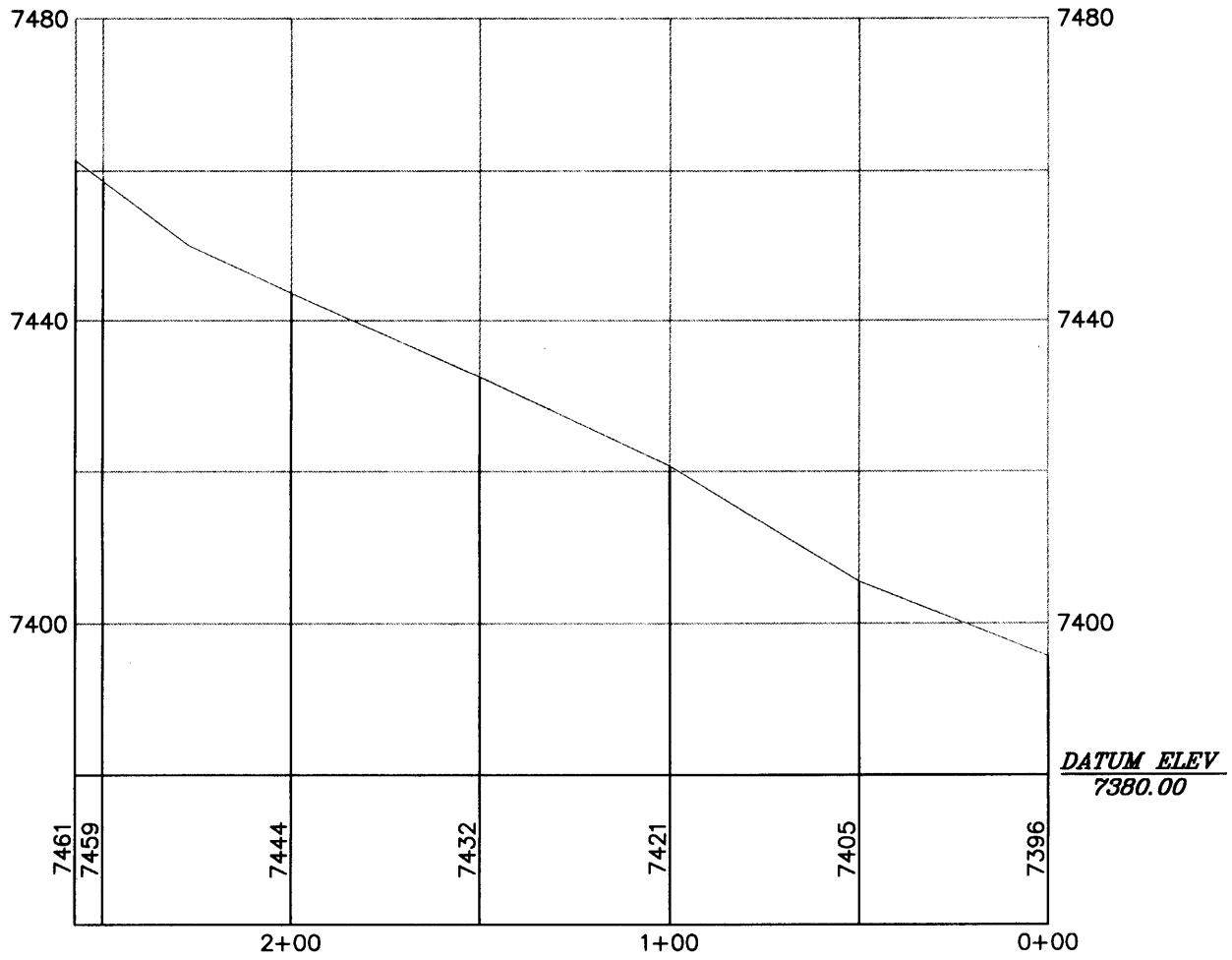

PROFILE SPRD-40

HORIZONTAL SCALE: 1=50'
VERTICAL SCALE: 1=25'

FIGURE 33. AS-BUILT RECLAMATION CHANNEL PROFILES

EarthFax

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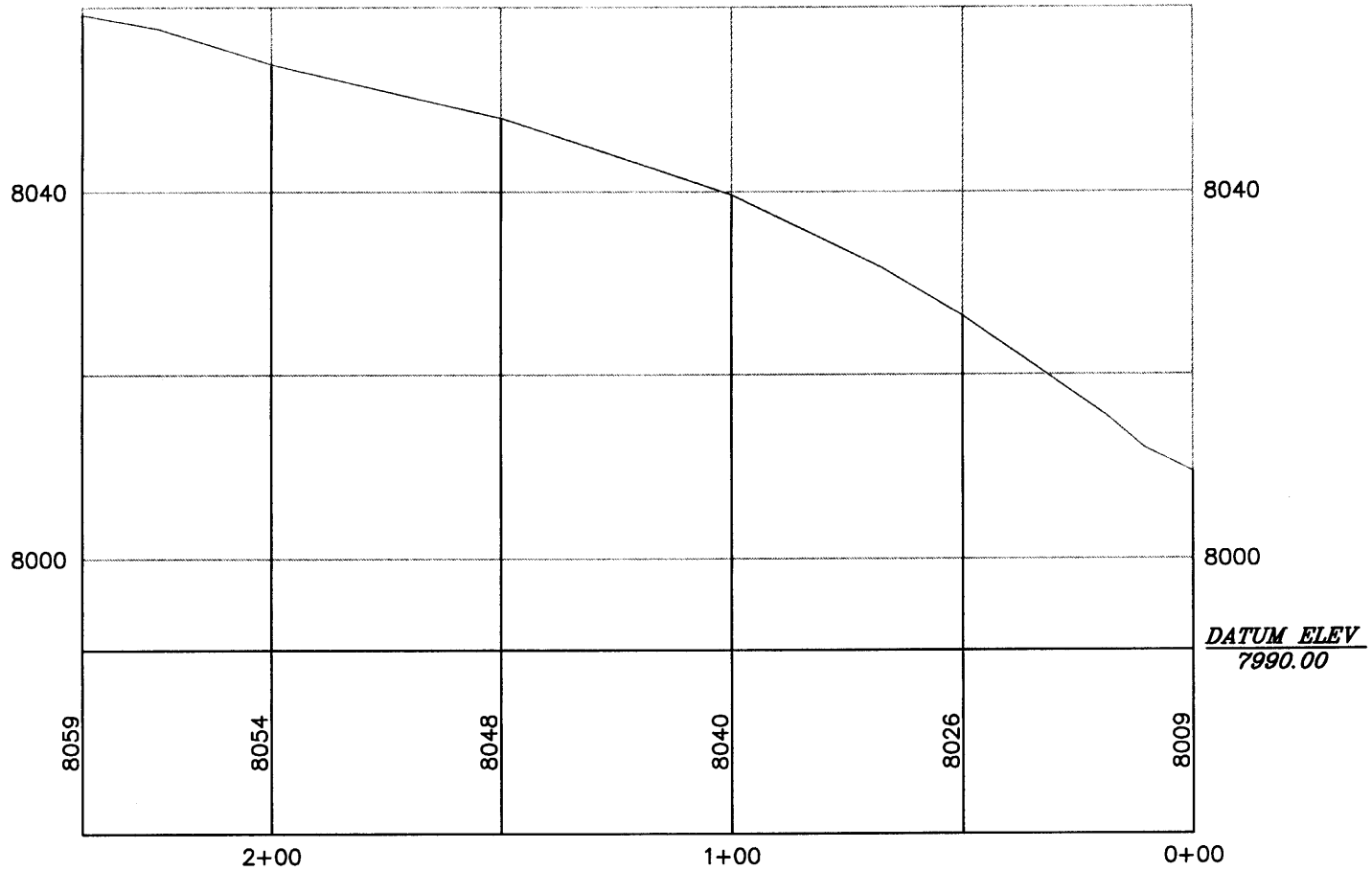

PROFILE SPRD-44

HORIZONTAL SCALE: 1=40'
VERTICAL SCALE: 1=20'

FIGURE 34. AS-BUILT RECLAMATION CHANNEL PROFILES

EarthFax

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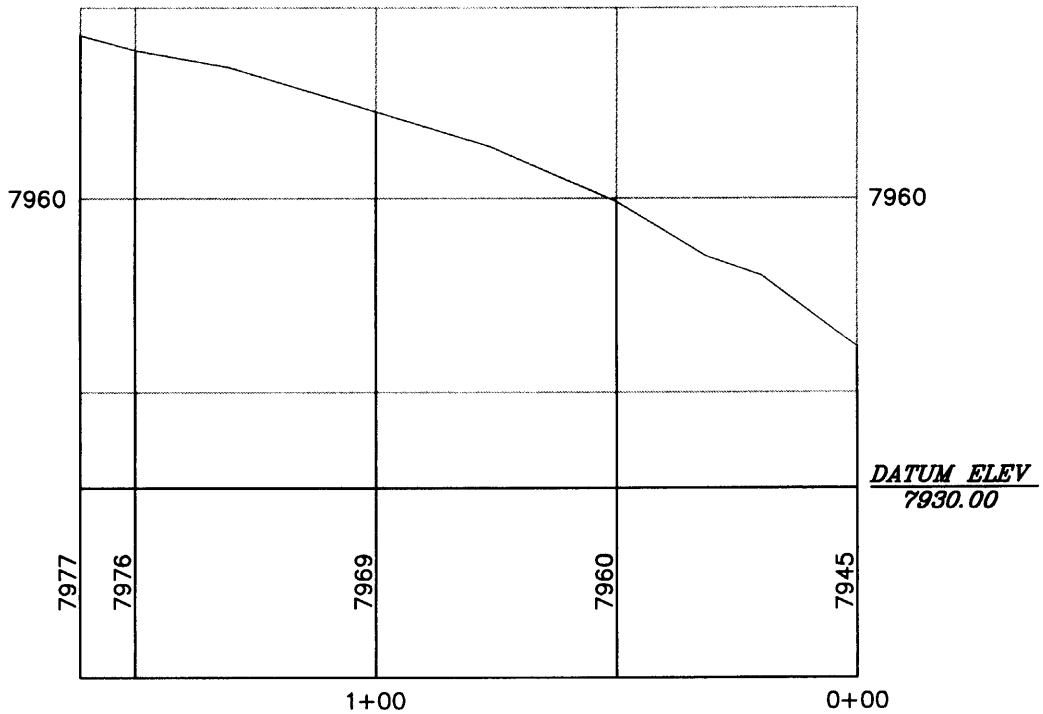

PROFILE SPRD-45

HORIZONTAL SCALE: 1=40'
VERTICAL SCALE: 1=20'

FIGURE 35. AS-BUILT RECLAMATION CHANNEL PROFILES

EarthFax

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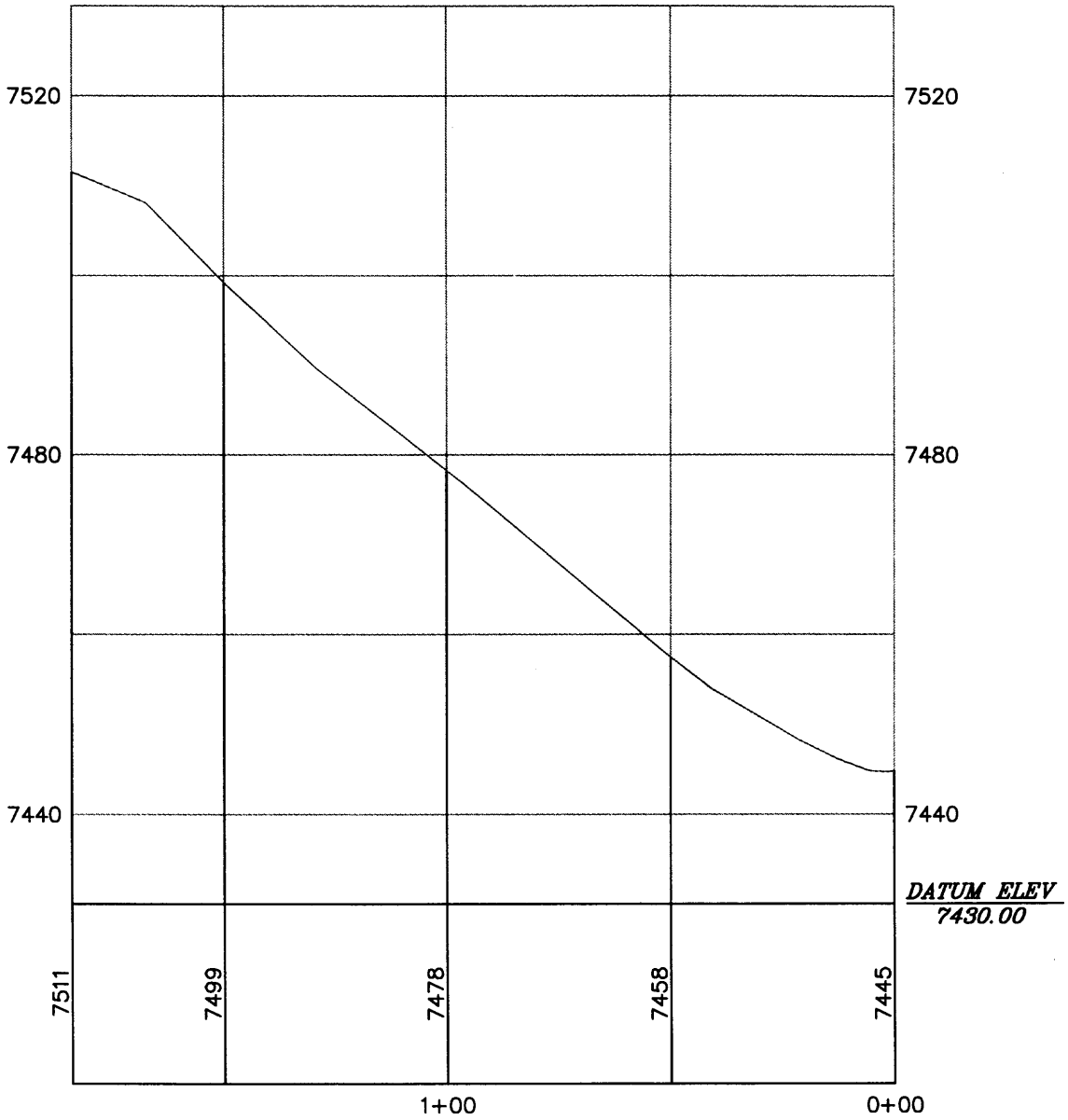
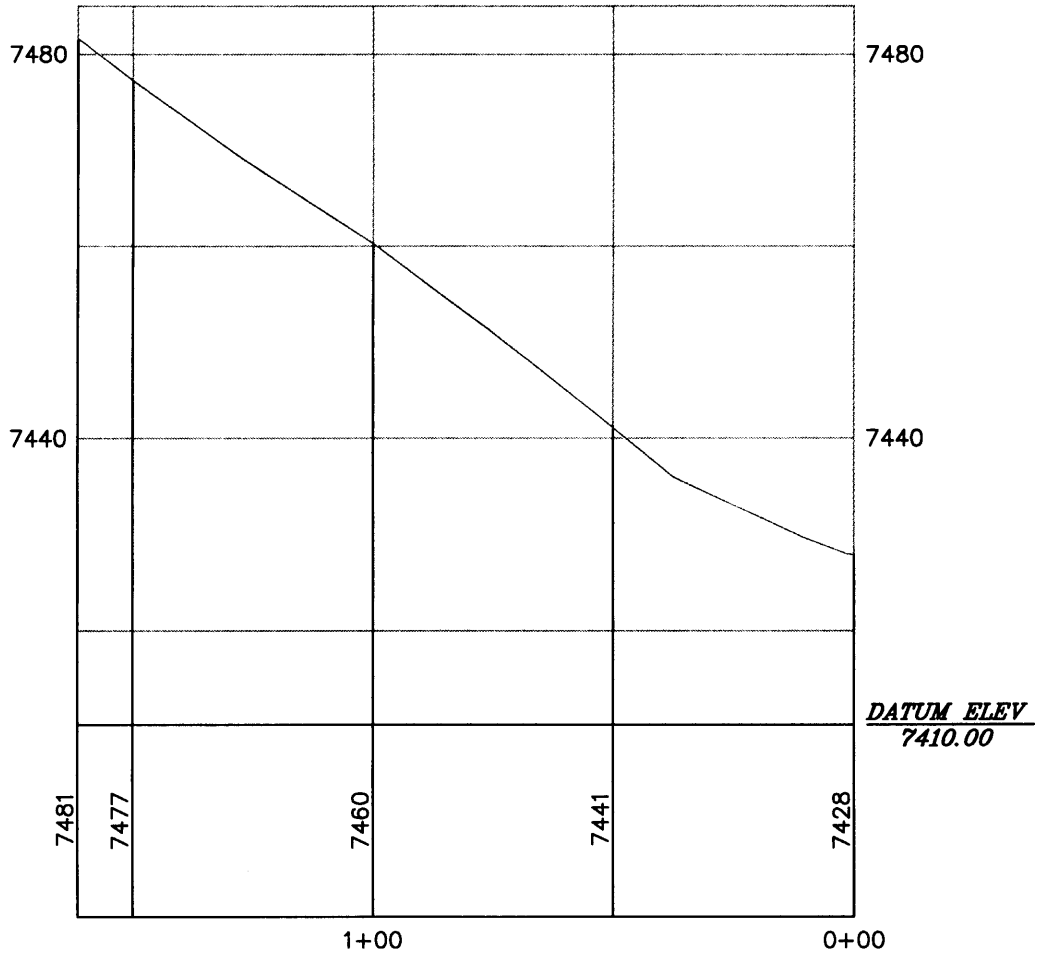


PROFILE SPRD-46

HORIZONTAL SCALE: 1=40'
VERTICAL SCALE: 1=20'

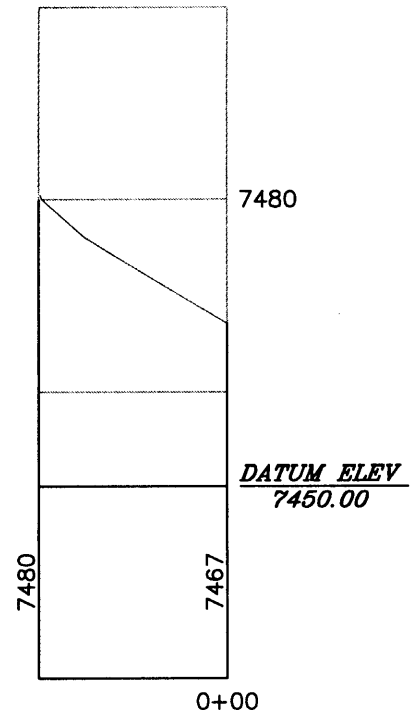
FIGURE 36. AS-BUILT RECLAMATION CHANNEL PROFILES

EarthFax



PROFILE SPRD-47

HORIZONTAL SCALE: 1=40'
VERTICAL SCALE: 1=20'



PROFILE SPRD-47A

HORIZONTAL SCALE: 1=40'
VERTICAL SCALE: 1=20'

FIGURE 37. AS-BUILT RECLAMATION CHANNEL PROFILES

EarthFax

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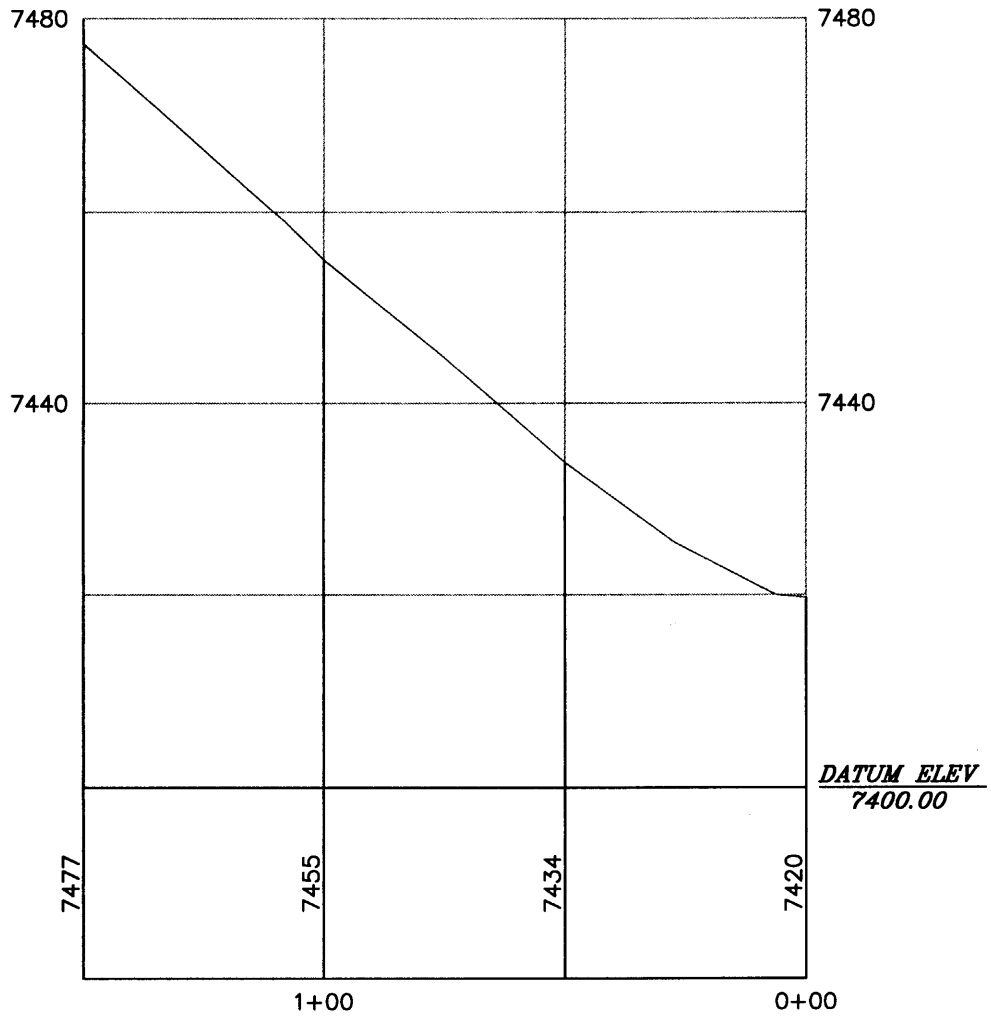


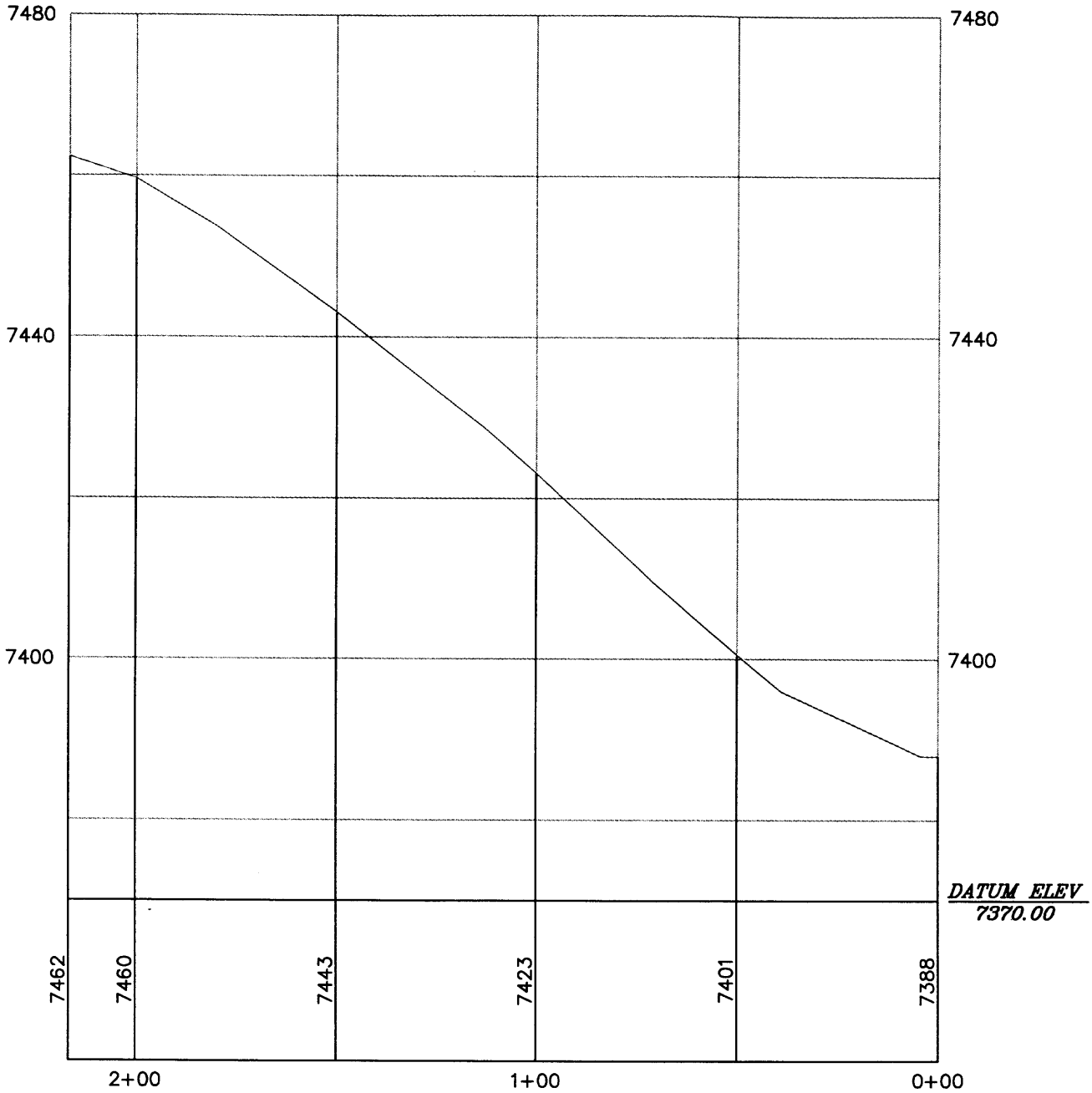
PROFILE SPRD-48

HORIZONTAL SCALE: 1=40'
VERTICAL SCALE: 1=20'

FIGURE 38. AS-BUILT RECLAMATION CHANNEL PROFILES

EarthFax

G:\UC779\07\DWG\PRO-5.DWG\10-08-03



PROFILE SPRD-49

HORIZONTAL SCALE: 1=40'
VERTICAL SCALE: 1=20'

FIGURE 39. AS-BUILT RECLAMATION CHANNEL PROFILES

EarthFax

Map(s) is kept with this application located in the Public Information Center of our Salt Lake City office.