SOIL SURVEY FOR URBAN SUITABILITY ANALYSIS:

TOWN OF GOLDEN, B.C.

by

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URBAN SUITABILITY ANALYSIS, TOWN OF GOLDEN, B.C.

Introduction:

Urban suitability mapping for the Town of Golden, B.C. and its newly incorporated areas was requested by the B.C. Department of Municipal Affairs, Planning Services to the B.C. Environment and Land Use Committee Secretariat, Resource Analysis Unit. This request was handled by the surficial geology and soils division of the E.L.U.C. The purpose of this report is to furnish the information useful in community planning for the undeveloped area of the Town of Golden, B.C. The urban suitability mapping is based on delineation of mapping units, at a scale of 1:6,000, corresponding to different kinds of surficial geology materials, topography and soil drainage classes which are presented as a series of map overlays. Preliminary mapping was done using air photos at a scale of 1:15,840. Interpretive ratings of this information were compiled for several selected uses including;

A. soil limitations for:

1. septic tank absorption fields
2. dwellings and/or low buildings
    a) with basements
    b) without basements
3. sewage lagoon and/or water reservoir areas
4. sanitary landfills
    a) trench type
    b) area type

5. shallow excavations

B. soil (material) suitability for:

1. sources of sand and gravel aggregate

C. hazard ratings for:

1. soil erosion potential

Tables showing the results of the interpretations are presented in the discussion.

Location of the Study Area:

The Town of Golden is located at the junction of the Kicking Horse River and the Columbia River in the southeastern part of British Columbia. The study area includes the Town of Golden and its newly incorporated areas as well as slight extensions outside the boundaries of the town to fit the geographical boundaries of the area. Figure 1, shows the location of the Town of Golden in relation to the remainder of the province of B.C. Figure 2 indicates the extent of the Town of Golden with its newly incorporated areas and the air photo flight line numbers used in the mapping.

Methodology:

(a) Field

The area mapped was first delineated on an air photo mosaic at a scale of approximately 1:6,000 or 1" = 500' and 20 chain black and white air photos at a scale of approximately 1:15,840 or 1" = 1320'.

MAP OF BRITISH COLUMBIA SHOWING LOCATION OF GOLDEN, B.C.

FIGURE 1

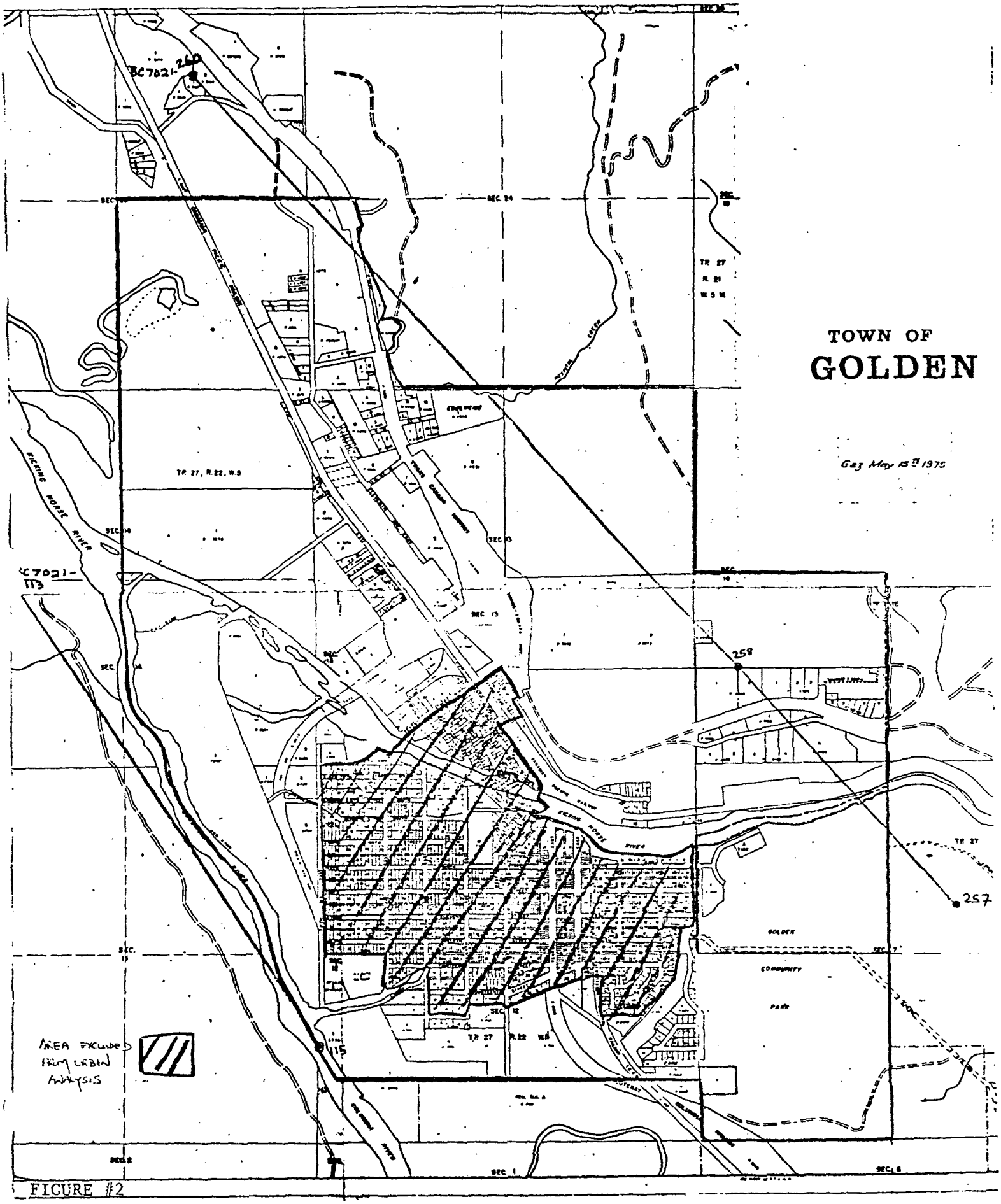

TOWN OF
GOLDEN
Gaz May 15th 1975
BC7021-260
BC7021-113
TP 27, R 22, W 5
TP 27
R 21
W 5 M
TP 27
R 22 W5
SEC 24
SEC 13
SEC 12
SEC 1
SEC 7
SEC 18
SEC 19
SEC 30
SEC 25
SEC 36
SEC 31
SEC 6
SEC 5
SEC 8
259
257
115
KICKING HORSE RIVER
GOLDEN
COMMUNITY
PARK
AREA EXCLUDED FROM URBAN ANALYSIS

FIGURE #2

Stereoscopic interpretation of the 20 chain air photos was undertaken and surficial materials delineated. These units were then field checked to determine the actual material composition, and to finalize the boundaries of these map units. Representative samples of the significant materials were collected in the field for laboratory analysis of physical characteristics. At the time of sampling the following characteristics of the map units were described:

1. soil development
2. slopes (%)
3. stoniness class (CDA, 1973)
4. rockiness class (CDA, 1973)
5. permeability class (estimated)
6. flooding frequency, estimated from the depth to the water table and the presence or abscence of evidence of periodic wetness in the soil
7. depth to water table, where it was encountered
8. percentage of organic matter incorporated into the surface mineral horizon
9. depths of sands and gravels
10. soil drainage class
11. native vegetation (general).

This data was also collected for those map units which were not sampled to provide background data for the final unit delineation and description. With

this additional information, the map unit boundaries and descriptions were finalized.

(b) Laboratory

Laboratory analyses of the materials sampled included mechanical analysis to determine textural classes of the matrices (U.S.D.A., 1951) and the coarse fragment content. Atterburg limits (liquid and plastic limits) (Sowers, 1965) were also determined to support the engineering interpretations required for the project.

(c) Office

Boundary lines delineating the materials were transferred from the 1:15,840 air photos to the 1:6,000 air photo mosaic. This mosaic is intended to be used as a base for the overlay of other information drafted on transparent paper. Three transparent overlays were prepared and show the extent and distribution of:

1. surficial materials
2. slopes (topography) and,
3. soil drainage classes.

The background data, as described above, was then used in conjunction with these transparent overlays to determine interpretive ratings for each map unit for selected uses. These interpretations were made

using the "Guide for Interpreting Engineering Uses of Soils" (U.S.D.A. Soil Conservation Service, 1971) for those selected uses described.

Description of Soils and Surficial Materials:

From field inspection there did not appear to be any restrictions regarding the uses described. Because of this, the surficial materials physical characteristics, i.e. texture, in conjunction with soil drainage classes, and topographic features are considered as the prime factors affecting the interpretive ratings. Appendix #1 contains the air photo map of surficial materials showing only the map unit boundaries. Appendix #2 is a transparent overlay of the surficial materials. Each map unit is numbered and corresponds to the number given in each table. Table #1 shows some selected physical properties of the materials.

Some of the symbols used in the data table are defined as follows:

NP = non plastic

NL = non liquid

lsg = loamy sandy gravel

slg = sandy loamy gravel

sl = sandy loam

ȿ = silt

gȿ = gravelly silt

ȿl = silty loam

vgȿl = very gravelly silty loam

Table No. 1 SOME PHYSICAL CHARACTERISTICS OF THE SURFICIAL MATERIALS OF THE TOWN OF COLDEN, B.C.

Map mbol	Description	Slope	Depth to Seasonal Water Table	Stoniness Class	Rockiness Class	Permeability Class	Flooding Frequency	Organic Matter Content of Surface Mineral	Depth of Sands and Gravels	Soil Drainage Class	Plastic Limit	Liquid Limit	Coarse Fragments >2-80mm	Sand 2-0.4mm	Silt 0.4-0.002 mm	Textural Class
		% (°)	m					%	m		% water	content	% of total	% of <2mm	fraction	
1	gF_1^A	0-5 (0-3)	0.5	0	0	moderately rapid	frequently	<5	>0.5	poorly	NP	NL	63.6	29.6	12.8	lsg
2	$\frac{sF_{vb}^A}{gF_1}$ - EX	2-5 (1-3)	2	0	0	moderately rapid	frequently	<5	2	poorly-imperfectly	NP	NL	0.2	49.0	47.1	sl
3	$\frac{sF_{vb}^I}{gFl}$ - EX	2-5 (1-3)	>2	0	0	moderately rapid	occasionally	<5	≥2	imperfectly	NP NP	NL NL	0.2 75.8	44.6 17.6	48.0 24.8	sl-gl lsg
4	$\frac{gsFv}{gFl}$ -Ex: gFl	0-5 (0-3)	0.8	0	0	rapid	frequently	5-10	>2	poorly	NP NP	NL NL	0.2 75.8	44.6 17.6	48.0 24.8	sl-gl lsg
5	gFl - B	0-2 (0-1)	0-0.5	1	0	rapid	frequently	5-10	>1	very poorly	NP	NL	75.8	17.6	24.8	lsg
6	gFl	0-2 (0-1)	>1	0	0	moderately rapid	occasionally	<5	1	well	34.4	37.0	0.6	29.6	67.8	gl ∞ I
7	gFl - X	0 (0)	0-0.8	0	0	slow	frequently	5-10	>1	poorly-very poorly	28.0	37.4	0	19.1	75.0	g-gl
8	$\frac{gFv}{gFl}$ - X	0-2 (0-1)	0-0.8	0	0	slow-moderate	occasionally	<5	>1	poorly	28.0	37.4	0	19.1	75.0	g-gl
9	gF_1^I - X	<0-2 (<0-1)	>0.5	0	0	moderately rapid	frequently	<5	>0.5	poorly	26.9	30.4	0.4	20.7	73.6	gl
10	gFf	0-3 (0-1)	≥2	0	0	moderately rapid	occasionally	<5	0.5-2	moderately well-well	NP	NL	75.8	17.2	20.0	slg
11	$\frac{gFv}{gFf}$	0-3 (0-1)	>2	1	0	moderately rapid	occasionally	10	>2	well	NP NP	NL NL	0.3 75.8	38.8 17.2	53.3 20.0	gl slg
12	bgFf	0-5 (0-3)	>2	2	0	moderately rapid	occasionally	<5	>2	well	NP	NL	75.8	17.2	20.0	slg
		10	>2	0	0	moderate	none	<5	none	well	24.9	32.3	0	0.8	94.7	g

Table No. 1

SOME PHYSICAL CHARACTERISTICS OF THE SURFICIAL MATERIALS OF THE TOWN OF GOLDEN, B.C.

Map Symbol	Description	Slope	Depth to Seasonal Water Table	Stoniness Class	Rockiness Class	Permeability Class	Flooding Frequency	Organic Matter Content of Surface Mineral	Depth of Sands and Gravels	Soil Drainage Class	Plastic Limit	Liquid Limit	Coarse Fragments >2-80mm	Sand 2-0.4mm	Silt 0.4-0.002 mm	Textural Class
		% (^{O})	m					%	m		% water	content	% of total	% of <2mm	fraction	
14	gFt	0-5 (0-3)	>2	1	0	rapid	none	<5	60	well	NP	NL	63.6	29.6	12.8	lsg
15	gFi	45-60 (24-31)	>2	1	0	rapid	none	<5	70	well-rapidly	NP	NL	63.0	30.6	13.8	lsg
16	(gsFi/gFi)-V	50 (26)	>2	0	0	moderate	none	<5	none	well-rapidly	17.4	26.6	18.3	12.8	82.8	gg
17	$\frac{gFi^{G}}{dFi^{G}}$ //	55-70 (29-35)	>2	1	0	moderate	none	<5	none	well-rapidly	17.4	26.6	18.3	12.8	82.8	gg
18	gFt// $\frac{gFv}{gFt}$	0-5 (0-3)	>3	1	0	moderately slow	none	<5	>3	well	17.0 NP	21.6 NL	0 63.6	9.5 29.6	84.8 12.8	g lsg
19	gFl	2-5 (1-3)	>1	0	0	slow	frequently	<5	1	moderately well-well	28.0	37.4	0	19.1	75.0	g-gl
20	gFl/ $\frac{sFv}{bgFl}$	2-5 (1-3)	>0.6	0	0	moderately rapid	occasionally	<5	1	well-imperfectly	NP NP	NL NL	0 75.8	61.1 17.2	33.5 20.0	sl slg
21	$\frac{gFv}{gFt}$	0-5 (0-3)	>1	1	0	moderate	none	5-10	>2	well	17.0 NP	21.6 NL	0 63.6	9.5 29.6	84.8 12.8	g lsg
22	gFi	25-30 (14-19)	>1	1	0	moderately rapid	none	5-10	>2	well-rapidly	NP	NL	63.6	29.6	12.8	lsg
23	$\frac{gF^{G}i}{dF^{G}i}$ //	5-10 (3-6)	>3	2	0	moderately rapid	none	5-10	none	well	17.4	26.6	18.3	12.8	82.8	gg
24	$\frac{fsEv}{gFt}$	0-5 (0-3)	>1	0	0	moderately rapid	none	<5	>1	well	NP NP	NL NL	0 63.6	61.1 29.6	33.5 12.8	sl lsg
25	gMbi	50 (26)	>2	2	1	moderate	none	<5	none	well-rapidly	17.4	26.6	18.3	12.8	82.8	gg
	[illegible]//	5-10														

Table No. 1 SOME PHYSICAL CHARACTERISTICS OF THE SURFICIAL MATERIALS OF THE TOWN OF GOLDEN, B.C.

ap mbol	Descript-ion	Slope	Depth to Seasonal Water Table	Ston-iness Class	Rock-iness Class	Perm-eability Class	Flooding Frequency	Organic Matter Content of Surface Mineral	Depth of Sands and Gravels	Soil Drainage Class	Plastic Limit	Liquid Limit	Coarse Fragments >2-80mm	Sand 2-0.4 mm	Silt 0.4-0.002 mm	Textural Class
		% (°)	m					%	m		% water	content	% of total	% of <2mm	fraction	
27	⁄Mbr	30-45 (17-24)	>2	2-3	1	moderate	none	<5	none	well	17.4	26.6	18.3	12.8	82.8	g⁄
28	⁄Mbi	25-35 (14-19)	>60	1	1	moderate	none	<5	none	well	17.4	26.6	18.3	12.8	82.8	g⁄
29	⁄sMbi	15 (8)	>60	1	1	moderate	none	<5	none	well	19.1	24.2	47.8	9.3	76.6	vg⁄l
30	⁄Mbu	5-10 (3-6) minor 20-50 (11-26)	>60	1	1	moderately rapid	none	<5	none	well	18.1	26.3	32.7	13.6	78.1	g⁄l
31	⁄Mt	0-5 (0-3)	>20	1	0	moderate	none	<5	none	well	14.9	20.4	31.8	16.7	73.8	g⁄l
32	⁄Mb/⁄sLb	70+ (35+)	>20	1	0	moderate	none	<5	none	rapidly	14.9	20.5	31.8	16.7	73.8	g⁄l
33	Rs	70+ (35+)	>20	1	5	slow	none	<5	none	rapidly	NP	NL	---------- ROCK OUTCROP ----------			
34	(Rs// rCv) -V	70+ (35+)	>20	1	5	slow	none	<5	none	rapidly	NP	NL	---------- ROCK OUTCROP ----------			
35	0	<0-5 (<0-3)	0.5	1	0	moderate	frequently	5-10	none	imperfectly -poorly	----------	----------	NOT DETERMINED----------			

Transparent overlays of slopes (Appendix #3) and drainage classes (Appendix #4) are also used to simplify presentation of the information given. A generalized description of each individual map unit follows.

Map Unit

1 Fluvial gravels of the active floodplain of the Columbia and Kicking Horse Rivers; flooded annually; slopes generally 0-5% or 0-3°; primarily Gleyed Orthic and Cumulic Regosol soil development; strongly calcareous materials; little vegetation cover, primarily black cottonwood, willow, alder and equisitum.

2 Veneer of sandy loam fluvial material overlying fluvial gravels of the Columbia and Kicking Horse Rivers; flooded annually; meander channels of the river cut into the deposit some with standing water throughout the year; slopes generally 2-5% or 1-3°; primarily Orthic Regosol soil development; strongly calcareous; parts of the unit have been recently cleared and cultivated; high water table due to groundwater seepage through gravels from Columbia and Kicking Horse Rivers; Rocky Mountain Juniper and white spruce dominant tree species, with dwarf birch, willows, vaccinium, grasses, asters, and dwarf juniper in very open stand with light ground cover.

3 Same as map unit #2 except has more vegetative cover, is not actively flooded, and is at a slightly higher elevation; lower terrace.

Map Unit

4 Same as map unit #3 except this unit has an inclusion of approximately 10% fluvial gravels which lack the sandy loam fluvial veneer of map units 2 and 3; the veneer varies in depth from none to 2 meters with an average depth of 50 centimeters; trails and tracks give evidence of heavy recreational use of this area when not innundated; approximately 25% cobbles found in this material.

5 Fluvial gravels which have been bulldozed to form a dyke along the bank of the Kicking Horse River; Orthic Regosol soil development; strongly calcareous; high water table due to seepage through gravels, from the river; little vegetation established; slopes generally depressional 0-2 % or 0-1°.

6 Fluvial silts; upper Columbia and Kicking Horse Rivers terrace; strongly calcareous; Orthic Eutric Brunisol soil development; slopes generally 0-2% (0-1°); part of this unit is presently treed and used as a playground and another part is an abandoned alfalfa field; vegetation Douglas fir and trembling aspen, with roses and alder shrub understory and some grass cover.

Map Unit

7 Fluvial silts; flooded annually by groundwater seepage and occasionally by Columbia River overflow; strongly calcareous at 65 centimeters depth; slopes level to depressional; Orthic Gleysol soil development; standing water present in some parts of the unit; part of unit covered with 15-20 cm of hog-fuel which is moderately decomposed; primarily wetland vegetation, mosses, sedges, water parsnip, and willows in slightly drier sites.

8 Fluvial silts and fine sands; lévees along the Columbia River; wet for large portion of the year, due to seepage from the Columbia and innundation during high flow periods; Orthic Regosol soil development; strongly calcareous to surface; slopes generally 0-2% (0-1°); primarily equisitum vegetation on recent deposits and white spruce, aspen alder and willow on more established areas.

9 Fluvial silts and fine sands of the Columbia and Kicking Horse Rivers with standing water on approximately 20% of the unit for a large proportion of the year; Orthic Regosol soil development; strongly calcareous at 50 cm depth; slopes generally depressional to 2% (<0-1°); primarily rush, sedge and equisitum vegetation with some dwarf birch.

Map Unit

10 Fluvial gravels deposited in a fan by Hospital Creek; seldom flooded, Orthic Regosol soil development; parent material strongly calcareous; slopes generally 0-3% (0-1°); little native vegetation remaining due to clearing, but some spruce, aspen, willow, and grasses.

11 Veneer of fluvial silts overlying fluvial gravels in a fan deposit of Hospital Creek; seldom flooded; Orthic Regosol soil development; strongly calcareous to surface; slopes generally 0-3% (0-1°); silt veneer variable depth from none to 1 meter, average 50 cm; presently largely developed in commercial enterprises, some pastureland, little natural vegetation remaining except some black cottonwood and spruce along the stream bank.

12 Bouldery, gravelly fluvial deposit of the Hospital Creek; occasionally flooded; Orthic Regosol soil development; strongly calcareous to the surface; slopes generally 0-5% (0-3°); primarily developed into mobile home park with very small area of natural vegetation primarily white spruce trees with little understory; this fluvial fan deposit is located at the foot of an extremely steep-sided rock canyon. This canyon would have a concentrating effect on the velocity of flow in Hospital Creek if parts of the watershed upstream were logged or flow released suddenly as from a

Map Unit

debris jam; the trailer park at the foot of Hospital Creek Canyon would likely be in the path of high velocity water and debris. Therefore cautions should be taken to avoid severe disturbance of the upper reaches of Hospital Creek above the canyon.

13 Silty fluvial fan derived from kame terraces; Degraded Eutric Brunisol soil development; strongly calcareous; may find some poorly sorted gravels interbedded with the silts; slopes generally 10% (6^{o}); vegetation types are predominantly moderately dense Douglas fir forest with shepherdia, saskatoon berries, Douglas maple, mountain ash, and dwarf juniper; however some of these fans have been cleared and cultivated for pastureland.

14 Sandy gravelly fluvial terrace; Orthic and Degraded Eutric Brunisol soil developments intermixed; strongly calcareous; slopes generally 0-5% ($0-3^{o}$); a $Ca(CO_3)_2$ accumulation zone may act as a temporary impediment to water movement through the soil but not enough to restrict its uses; vegetation predominantly Douglas fir with Douglas maple, shepherdia, saskatoon berries, and pinegrass cover.

Map Unit

15 Gravelly sandy fluvial escarpment(s); approximately 80 meters high (ranging from 30-100m); Orthic Eutric Brunisol soil development; slopes generally 45-60% (24-31°); weakly cemented; strongly calcareous; "pistol-butt" shape of tree trunks indicates gradual downslope movement; slopes appear to be highly susceptible to soil erosion if subjected to concentrated flows of water as evidenced by a large gully where a stream diversion escaped down the escarpment; part of this unit is presently used as a gravel pit and when over-steepened is subject to constant downslope movement; primarily Douglas fir, aspen, shepherdia, saskatoon berry, moss, lichen, and grass vegetation.

16 Gullied steep fluvial silty sandy gravels with approximately 40% steep gravelly silty sands; deep gullies indicate zones of gravelly silty sands grading to gravels with a silty sandy matrix at the gully edges; Orthic Eutric Brunisol soil development; strongly calcareous; slopes generally 50% (26°); predominantly Douglas fir, aspen, shepherdia, saskatoon berry, moss, lichen and grass vegetation.

17 Silty fluvial gravels with approximately 20% diamicton fluvial materials; very poorly sorted sands and gravels with minor glacial till, silts and fine sands often interbedded with sorted gravels, sands and silts. Degraded Eutric Burnisol soil development; strongly

Map Unit

calcareous; slopes generally 55-70% (29-35°); predominantly Douglas fir, aspen, shepherdia, saskatoon berry, Douglas maple, mountain ash, and dwarf juniper vegetative cover.

18 Terraced fluvial gravels with approximately 20% of the unit having fluvial silts overlying the gravels; some evidence of perching of the water table in the silts above the gravels; Orthic Eutric Brunisol soil development; strongly calcareous; gravels weakly cemented; slopes generally 0-5% (0-3°); predominantly Douglas fir, aspen, shepherdia, saskatoon berry, Douglas maple, mountain ash, and dwarf juniper vegetative cover.

19 Fluvial silts in a glacial meltwater channel; Degraded Eutric Brunisol soil development; strongly calcareous parent material; possibly high water table for spring and early summer months; slopes generally 2% (1°); predominate vegetation types include aspen, some Douglas fir, dwarf juniper, black cottonwood, shepherdia, kinnickinnick, roses, vaccinium, and grasses.

20 Fluvial gravels with approximately 40% of the unit having a sandy fluvial veneer (0-1m thick) overlying the gravels; Orthic Eutric Brunisol soil development; strongly calcareous to the surface; slopes generally 2-5% (1-3°); presently diked and susceptible to

Map Unit

flooding by the Kicking Horse River without the protection of the dike, also presently the site of the Golden Municipal Park and Campsite; natural vegetation has been maintained where possible and includes mature Douglas fir trees, and white spruce as well as some Douglas maple, oregon grape, roses, vaccinium and thimbleberry understory.

21 Fluvial silts (0-1 meter thick) overlying terraced fluvial gravels and sands; Orthic Eutric Brunisol soil development; strongly calcareous; slopes generally 0-5% (0-3°); predominantly Douglas fir, Douglas maple, Shepherdia, Saskatoon berry, with some masses and lichens in a relatively open stand.

22 Fluvial gravels, lower edge of terrace described in unit #21; Orthic Eutric Brunisol soil development; strongly calcareous; slopes generally 25-30% (14-19°); similar vegetative growth to unit #21.

23 Undulating silty glacio-fluvial gravels with approximately 20% undulating diamicton glaciofluvial deposits; primarily poorly sorted sands and gravels with minor till plus silts; plus fine sands all intermixed and interbedded; Degraded Eutric Brunisol soil development; strongly calcareous; gravels moderately cemented by $Ca(CO_3)_2$ salts; slopes generally 5-10% (3-6°);

Map Unit

presently partially cultivated for agriculture with a few alpine houses built in the area; predominantly in native vegetation of Douglas fir, shepherdia, saskatoon berry, Douglas maple, mountain ash, and dwarf juniper in a moderately dense stand.

24 Veneer (0-1 meter thick) of fine sand aeolian deposits overlying terraced gravelly fluvial deposits in the form of cliff top dunes; Orthic Eutric Brunisol and Degraded Eutric Brunisol soil developments; strongly calcareous; slopes generally 5-10% (0-3°); vegetation primarily Douglas fir, relatively open stand, with Douglas maple, shepherdia, saskatoon berry, and some mosses and lichens in the understory; due to the proximity of these sand dunes to the cliffs of Hospital Creek Canyon there may be safety hazard for small children playing near the cliffs consequently any development of this area should be placed sufficiently far back from the cliffs to minimize this hazard.

25 A blanket (>1m thick) of gravelly silty glacial till material, on an escarpment of an upper glacial till deposit; Orthic Eutric Brunisol soil development; strongly calcareous; slopes generally 50% (26°); predominantly Douglas fir and associated vegetation as in previous units.

Map Unit

26 Undulating blanket (>1m thick) of gravelly silty glacial till deposits with approximately 20% inclusions of gravelly sandy glacial till deposits; Degraded Eutric Brunisol soil development; strongly calcareous; slopes generally 5-10% (3-6°); vegetation similar to that described in previous units.

27 Ridged blanket (>1m thick) of gravelly silty glacial till deposits; Degraded Eutric Brunisol soil development; strongly calcareous; slopes generally 30-45% (17-24°); vegetation as on described preceeding units.

28 Inclined blanket (>1m thick) of gravelly silty glacial till material; Degraded Eutric Brunisol soil development; strongly calcareous; slopes generally 25-35% (14-19°); predominately Douglas fir and associated vegetation as described in preceeding unit descriptions; small portion of unit used as town garbage disposal area.

29 Inclined blanket (>1m thick) of gravelly silty sandy glacial till material; Degraded Eutric Brunisol soil development; strongly calcareous; slopes generally 15% (8°); may be underlain at shallow depths by finely laminated calcareous siltstone bedrock, calcareous phyllite bedrock, and minor limestone bedrock as well as some lacustrine silty materials; predominantly Douglas fir and associated vegetation.

Map Unit

30 Undulating blanket (>1m thick) of gravelly silty sandy glacial till material; Orthic Eutric Brunisol soil development; strongly calcareous, slopes generally 5-10% (3-6°) with minor inclusions of slopes of 20-50% (11-26°); vegetation predominantly Douglas fir and associated vegetation, some parts of the unit have been logged and are revegetating to aspen and other shrubs.

31 Terraced gravelly silty glacial till deposits; Orthic Eutric Brunisol soil development; strongly calcareous; slopes generally 0-5% (0-3°); predominantly Douglas fir and associated vegetation, some parts of this unit have been cleared and are revegetating to aspen and other shrubs.

32 Escarpment of gravelly silty glacial till overlying silty sand lacustrine deposits; Orthic Regosol soil development; strongly calcareous; slopes generally 70% and greater (35°+); essentially no vegetation established on these materials; the contact zone of these materials may create perched water tables for part of the year.

33 Steep rock outcrop composed primarily of calcareous phyllite bedrock; essentially no soil development; strongly to moderately calcareous; slopes generally greater then 70% (35°+); essentially no vegetation established.

Map Unit

34 Steep gullied rock outcrop composed primarily of calcareous phyllite and limestone bedrock, with approximately 20% inclusion of a veneer of rubbly colluvium; essentially no soil development on cliff surfaces; strongly to moderately calcareous; slopes generally greater than 70% (35-90°); essentially no vegetation has been established.

35 Organic deposit in a depressional area; may be Peaty Phase Gleysol soil development; slopes generally <0-5% (<0-3°); predominantly spruce, dwarf juniper, lodgepole pine, and saskatoon berry vegetation.

Soil Interpretations:

The field and laboratory data were used to derive interpretations for suitability of each individual map unit for selected urban related uses of land. The uses for which soil limitation rating were derived included limitations for:

1. septic tank absorption fields
2. dwellings
    a) with basements, and
    b) without basements
3. sewage lagoon and/or water reservoir areas
4. sanitary landfills
    a) trench-type, and
    b) area type
5. shallow excavations

Urban related interpretations of suitability of the materials for a source of sand and gravel aggregate as well as hazard ratings for soil erosion were also carried out. These interpretative ratings were derived from field and laboratory data using the U.S. Department of Agriculture, Soil Conservation Service publication, (1971) as a guide. Specific soil characteristics have been recognized as affecting the use to which a soil or surficial material is put. The importance of these specific characteristics in terms of their affect on different uses varies with the use planned for that specific type of material. The parameters used in determining the suitability ratings for the various land uses described are as follows:

A. Soil limitations for

1. septic tank absorption field limiting factors include:

a) permeability class

b) depth to seasonal high water table

c) flooding frequency

d) slope

e) depth to hard rock, bedrock, or other impervious materials

f) stoniness class

g) rockiness class

2. Dwellings or low buildings with or without basements limiting factors include:

    a) soil drainage class

    b) seasonal high water table

    c) flooding frequency

    d) slope

    e) shrink-swell potential

    f) unified soil textural class

    g) potential frost action

    h) stoniness class

    i) rockiness class

    j) depth to bedrock

3. Sewage lagoon and/or water reservoir development limiting factors include:

    a) depth to seasonal high water table

    b) permeability class

    c) depth to bedrock

    d) slope

    e) percentage by volume of the material made up of coarse fragments of less than 10 inches in diameter

    f) percentage of organic matter incorporated into the surface mineral horizon

    g) flooding frequency

    h) unified soil textural class (rated for use mainly as floor of lagoon).

4. Trench type sanitary landfills limiting factors include:

    a) depth to seasonal high water
    b) soil drainage class
    c) flooding frequency
    d) permeability class
    e) slope
    f) soil textural class (U.S.D.A., dominant to a depth of 60 inches)
    g) depth to hard bedrock, depth to rippable bedrock
    h) stoniness class
    i) rockiness class

5. Area type sanitary landfills limiting factors include:

    a) soil textural class (U.S.D.A.)
    b) thickness of material (usually uppermost part of the profile)
    c) percentage, by volume, of coarse fragments greater than 2mm size
    d) stoniness class
    e) slope
    f) drainage class (only limiting if poorly or very poorly drained).

6. Shallow excavations limiting factors include:

    a) soil drainage class
    b) depth to seasonal high water table

c) flooding frequency, slope

d) textural class of the material to the depth to be excavated

e) depth to bedrock

f) stoniness class

g) rockiness class

B. Suitability for;

1. source of sand and gravel aggregate is limited by:

a) depth to seasonal high water table

b) thickness of the deposit

c) depth of the soil overlying the sand and gravel deposit

d) percentage, by weight, of gravel size (2mm-80mm) coarse fragments

e) percentage, by weight, of sand (0.4mm - 2.0mm)

f) percentage, by weight, of fines (<0.4mm)

C. Hazard rating for;

1. Soil erosion potential is determined by:

a) depth to impermeable layer

b) runoff potential

c) soil textural class

d) the estimated stability of the surface soil aggregates.

e) the topographic (slope) class

The characteristics sited above are then used to evaluate the soil limitation rating (i.e. slight, moderate or severe) for each selected land use on each of the map units delineated.

Slight soil limitation is the rating given soils that have properties favorable for the rated use. The degree of limitation is minor and can be overcome easily. Good performance and low maintenance can be expected.

Moderate soil limitation is the rating given soils that have properties moderately favorable for the rated use. This degree of limitation can be overcome or modified by special planning, design, or maintenance. Some soils rated moderate require treatment such as artificial drainage, runoff control to reduce erosion, extend sewage absorption fields, extra excavation, or some modification of certain features through manipulation of the soil.

Severe soil limitation is the rating given soils that have one or more properties unfavorable for the rated use, such as steep slopes, bedrock near the surface, flooding hazard, high shrink-swell potential, a seasonal high water table, or low bearing strength. This degree of limitation generally requires major soil reclamation, special design, or intensive maintenance which in some cases may be extreme. For example, very shallow soils over hard rock or deep, wet organic materials having severe limitations for houses with basements or for on-site sewage disposal. Some of these soils can, however, be improved by reducing or removing the soil feature that limits use, but in most situations, it is difficult and

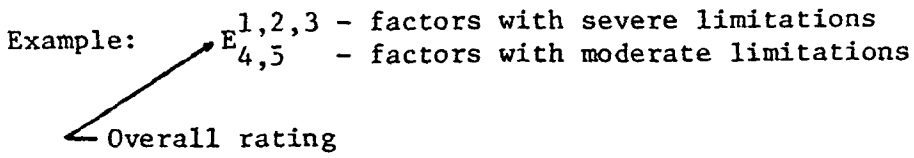
costly to alter the soil or to design a structure so as to compensate for a severe degree of limitation.

On the basis of the limitation rating for each map unit characteristic, an overall rating for each map unit was compiled for the selected urban related uses described previously. The pattern used to derive overall ratings was as follows:

1. rated slight (s) limitation, suitability, hazard, overall if all the factor ratings were of slight limitation.
2. rated moderate (m) limitation, suitability, hazard where one or more of the factors were rated moderate and/or one factor was rated severe.
3. rated severe (E) limitation, suitability, hazard where two or more of the factors were rated severe.

In some cases, due to inherent variability in the surficial materials a range of values for a particular property of a material may be encountered. In such cases it is possible to have a rating showing a range of limitations such as slight to moderate (S-M).

In the overall rating of each map unit for selected uses the rating is qualified by superscript and subscript numbers. The superscript numbers indicate those factors which were severely limiting. The subscript number indicate those factors which were moderately limiting. Here an example of the symbol and a definition of the abbreviations used is given:



S = slight limitation

M = moderate limitation

E = severe or extreme limitation

Limiting factors with corresponding numbers:

1. seasonally high water table
2. flooding hazard
3. rapid permeability
4. excessive slope
5. excessive stoniness
6. excessive rockiness
7. greater than 3 limiting factors contributing to the rating
8. poor drainage
9. unfavorable soil texture (primarily silty)
10. susceptible to frost heave
11. shallow depth to bedrock or impermeable layer
12. excessive gravel
13. unfavorable organic matter content
14. insufficient sand content
15. low gravel content (2mm-80mm size)
16. shallow depth of sand and/or gravel
17. excessive thickness of soil overlying sand and gravel deposit.

These conventions and their descriptions are used in all of the interpretive tables in this report.

Summary:

Interpretation ratings for selected urban uses of land were compiled for individual map units and are summarized in table number 2. Each unit rating is qualified by a number(s) indicating that (those) factor(s) which contribute significantly to the overall rating of that unit, as described in previous section. Generally, for septic tank absorption fields map unit 14 had slight limitations, map units 2, 3, 6, 10, 11, 12, 13, 15, 16, 17, 18, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, had moderate limitations, and the map units 1, 4, 5, 7, 8, 9, 19, 33, 34, 35, had severe limitations. A table showing the actual limitation ratings is given in appendix number 5.

Limitations of materials for dwellings or low buildings with and without basements are severe in map units, 1, 2, 3, 4, 5, 7, 8, 9, 33, 34, 35, slight in map units 14, 21, 24, and moderate in the remaining units. A table showing the specific limitation ratings is given in appendix number 6.

For sewage lagoon and/or water reservoir areas the limitations were slight in none of the map units, severe in map units 1, 2, 3, 4, 5, 7, 8, 9, 10, 12, 14, 15, 33, 34, 35 and moderate in the remaining units. Appendix number 7 shows the specific limiting factor ratings.

Table No. 2 SOIL INTERPRETATION RATINGS FOR SELECTED URBAN USES OF LAND

		SOIL LIMITATIONS FOR:							SUITABILITY FOR:	HAZARD RATING F
		Foundations for Low Buildings			Sanitary Landfills					
Map Unit	Slope % (°)	With Basements	Without Basements	Septic Tank Absorption Field	Sewage Lagoons	Trench Type	Area Type	Shallow Excavations	Sand & Gravel Aggregate Source	Soil Erosic
1	0-5 (0-3)	$E^{1,2,8}$	$E^{1,2,8}$	$E^{1,2}$	$E^{1,2,12}_{4,9}$	E^{7}	$E^{8,9,12}$	E^{7}	$E^{1,14}_{15,16}$	S
2	2-5 (1-3)	$E^{1,2,8}$	$E^{1,2}_{8}$	M^{2}	$E^{1,2,12}_{4,9}$	E^{7}	M^{8}	$E^{1,2,8}_{9}$	$M^{1}_{14,15}$	S
3	2-5 (1-3)	$E^{1,2,8}$	$E^{1,2,8}$	M^{2}	$E^{1,2,12}_{3,5,9}$	$E^{1,2,3}_{8}$	$E^{8,9,12}$	$E^{1,2,8}_{9}$	$M^{1}_{14,15}$	S
4	0-5 (0-3)	$E^{1,2,8}$	$E^{1,2}_{8}$	$E^{1,2}$	$E^{7}_{9,13}$	E^{7}	$E^{8,9,12}$	$E^{1,2,8}_{9}$	$M^{1}_{14,15}$	S
5	0-2 (0-1)	$E^{1,2,8}$	$E^{1,2,8}$	$E^{1,2}$	E^{7}_{9}	E^{7}	$E^{8,9,12}$	E^{7}	$E^{1,14}_{15}$	S
6	0-2 (0-1)	M^{2}	M^{2}	M^{2}_{1}	$M_{1,3,9}$	$M^{1}_{2,3,8}$	S	$M^{1,2,8}$	$M^{15}_{1,14,17}$	S
7	0 (0)	$E^{1,2,8}$	$E^{1,2,8}$	$E^{1,2,3}$	$E^{1,2}_{3,9,13}$	$E^{1,2,8}_{9}$	M^{8}	$E^{1,2,8}$	$E^{1,15}_{14}$	S
8	0-2 (0-1)	$E^{1,2,8}$	$E^{1,2,8}$	$E^{1,2,3}$	$E^{1,2}_{3,9}$	$E^{1,2,8}_{3}$	M^{8}	$E^{1,2,8}$	$E^{1,15}_{14}$	S
9	<0-2 (<0-1)	$E^{1,2,8}$	$E^{1,2,8}$	$E^{1,2}$	$E^{1,2}_{3,9}$	E^{7}	M^{8}	$E^{1,2,8}$	$E^{1,14,15}$	S
10	0-3 (0-1)	M^{2}	M^{2}	$M_{1,2}$	$E^{2,3,12}_{1,9}$	$E^{1,3,9}_{2}$	$M^{9,12}$	M_{7}	$M^{14}_{1,15}$	S
11	0-3 (0-1)	M^{2}	M^{2}	M^{2}	M^{12}_{7}	$M^{3,9}_{1,2,8}$	$M^{9,12}$	$M_{1,2,9}$	M^{14}_{15}	S
12	0-5 (0-3)	M^{2}_{5}	M^{2}_{5}	M^{2}	E^{7}_{9}	$E^{2,3,9}_{1,8}$	$M^{9,12}_{5}$	$M^{9}_{1,2,5}$	$M^{14}_{1,15}$	S
13	10 (6)	M_{7}	M_{7}	$M^{1,2,3}$	$M^{4}_{3,9}$	$M_{3,8,9}$	M_{4}	$M_{2,5,9}$	$E^{14,15}$	M
14	0-5 (0-3)	S	S	S	$E^{3,12}_{9}$	$M^{3,9}_{8}$	$M^{9,12}$	M^{9}	$M_{14,15}$	S
	45-60 (24-31)	M^{4}	M^{4}	M^{4}	$E^{3,4,12}_{9}$	$E^{3,4,9}_{8}$	$E^{4,9,12}$	$M^{4,9}$	$M_{14,15}$	M
16	50 (26)	M^{4}	M^{4}	M^{4}_{3}	$M^{4}_{3,9,12}$	$M^{4,9}_{3,8}$	$M^{4,9}_{12}$	M^{4}_{9}	$E^{14,15}$	E
17	55-70 (29-35)	M^{4}	M^{4}	M^{4}_{3}	$M^{4}_{3,9,12}$	$M^{4,9}_{3,8}$	$M^{4,9}_{12}$	M^{4}_{9}	$E^{14,15}$	E
18	0-5 (0-3)	$M_{9,10}$	$M_{9,10}$	M^{4}	$M_{3,9,12}$	$M_{3,8,9}$	$M_{9,12}$	M_{9}	$M_{14,15}$	S
19	2 (1)	M_{7}	$M_{9,10}$	$E^{1,3}_{2}$	$M_{1,2,9}$	$M_{2,9}$	M_{9}	M_{7}	$E^{1,14,15}$	S
20	2-5 (1-3)	M^{2}_{1}	M^{2}	M^{2}_{1}	$M^{2}_{3,4,9}$	$M_{2,3}$	S	$M_{1,2,9}$	$M_{1,14,15}$	S
21	0-5 (0-3)	S	S	$M_{2,3}$	M_{7}	$M_{2,8}$	$M^{9,12}$	M_{9}	$M_{14,15}$	S
22	25-30 (14-19)	M^{4}	M^{4}	M^{4}	M^{4}_{7}	$E^{3,4,9}_{8}$	$M^{9,12}_{4}$	$M^{4,9}$	$M_{14,15}$	M
23	5-10 (3-6)	$M_{4,5}$	$M_{4,5}$	$M_{4,5}$	M_{7}	$M^{3,9}_{5,8}$	$M^{9,12}$	$M_{4,9}$	M^{14}_{15}	M
24	0-5 (0-3)	S	S	M_{3}	M_{7}	$M^{3}_{4,8}$	$M_{9,12}$	S	$M_{14,15}$	S
25	50 (26)	M^{4}_{7}	M^{4}_{7}	M^{4}_{7}	$M^{4}_{3,5}$	M^{4}_{7}	$M^{4}_{5,9,12}$	$M^{4}_{5,6,9}$	$E^{14,15}$	E
26	5-10 (3-6)	M_{7}	M_{7}	$M_{3,4,5}$	M_{7}	M_{7}	M_{7}	M_{7}	$E^{14,15}$	S
27	30-45 (17-24)	M^{4}_{7}	M^{4}_{7}	$M^{4}_{3,5}$	M^{4}_{7}	M^{4}_{7}	$M^{4}_{5,9,12}$	$M^{4}_{5,6,9}$	$E^{14,15}$	M
28	25-35 (14-19)	M^{4}_{7}	M^{4}_{7}	$M^{4}_{3,6}$	M^{4}_{7}	M^{4}_{7}	$M^{4}_{9,12}$	$M^{4}_{6,9}$	$E^{14,15}$	M
29	15 (8)	M_{7}	M_{7}	$M_{3,4,6}$	M^{4}_{7}	M_{7}	M^{12}_{4}	$M_{4,6,9}$	M^{14}_{15}	S
30	5-10 (3-6)	M_{7}	M_{7}	$M_{4,6}$	M^{4}_{7}	$M^{3}_{6,8,9}$	$M_{4,12}$	$M_{4,6,9}$	M^{14}_{15}	S
31	0-5 (0-3)	$M_{9,10}$	$M_{9,10}$	M_{3}	M^{4}_{7}	$M_{3,8,9}$	M_{12}	M_{9}	M^{14}_{15}	S
	70+ (35+)	$M^{4}_{9,10}$	$M^{4}_{9,10}$	M^{4}_{3}	$M^{4}_{3,9,12}$	$M^{4}_{3,8,9}$	M^{4}_{12}	M^{4}_{9}	M^{14}_{15}	E
33	70+ (35+)	$E^{4,6,11}$	$E^{4,6,11}$	E^{7}	$E^{4,11}$	E^{7}	E^{7}	E^{7}	$E^{14,15}$	E
34	70+ (35-90)	$E^{4,6,11}$	$E^{4,6,11}$	E^{7}	$E^{4,11}$	E^{7}	E^{7}	E^{7}	$E^{14,15}$	E
35	<0-5 (<0-3)	E^{7}	E^{7}	$E^{1,2}_{3}$	$E^{1,2,9}_{3}$	$M^{1,2}_{3,8}$	$M^{8,9}$	E^{7}	$E^{1,14,15}$	S

For trench type sanitary landfills there were slight limitations in none of the map units, severe limitations in map units 1, 2, 3, 4, 5, 7, 8, 9, 10, 12, 15, 22, 33, 34, and moderate limitations in the remaining units. Appendix number 8 gives the details of the limitation ratings.

Map units to be used for area type landfills had slight limitation in map units 6 and 20, severe limitations in map units 1, 3, 4, 5, 15, 33, 34, and moderate in the remaining map units. (Appendix number 9).

Material limitations for shallow excavations were slight for map units 24, severe in map units 1, 2, 3, 4, 5, 7, 8, 9, 33, 34, 35, and moderate in the remaining map units (Appendix No. 10).

The suitability of the soils/surficial materials in the map area for a source of sand and gravel aggregate were rated as good or of slight limitation for none of the map unit, as poor or of severe limitation for map units 1, 5, 7, 8, 9, 13, 16, 17, 19, 25, 26, 27, 28, 33, 34, 35 and of moderate suitability for the remaining map units. A table showing the limiting factor rating and giving some general comments about the individual deposits is given in Appendix number 11.

Hazard ratings for soil erosion potential were also compiled. Map units 16, 17, 25, 32, 33, 34 were rated as having severe soil erosion hazard potential, map units 13, 15, 22, 23, 27, 28 were rated as having moderate potential for soil erosion, and the remaining map units had slight soil erosion potential, (Appendix No. 12).

Recommendations:

The recommendations arising from the soils/surficial material, drainage and slope mapping with the subsequent interpretive rating of this data as to its limitations, suitability, and hazard for use for selected urban uses are fourfold. First, those areas which have slight limitation, or good suitability, or slight soil erosion hazard ratings for selected uses should, wherever possible be utilized primarily for those uses. Second, those areas which are rated as having moderate limitations should be investigated more closely as to the limiting factors contributing to the that rating to determine areas where the land can be most easily, and economically manipulated to fit the use for which it is intended. Third, those areas which are rated as having severe limitations for specific uses should be avoided wherever possible. And fourth, perhaps most important, the data supplied in this report does not negate the need for specific on-site data for specific urban uses, due to the inherent variability in natural landscape materials. This is particularly true for design of heavy structures, sewage lagoons and other site specific uses.

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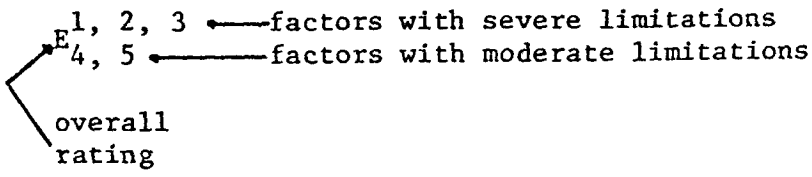
LEGEND FOR APPENDICES 5, 6, 7, 8, 9, 10, 11, 12

example of symbol



S = slight limitations

M = moderate limitations

E = severe or extreme limitations

Limiting factors with corresponding numbers:

1. seasonally high water table
2. flooding hazard
3. rapid permeability
4. excessive slope
5. excessive stoniness
6. excessive rockiness
7. greater than 3 limiting factors contributing to the overall rating
8. poor drainage
9. unfavorable soil texture (primarily silty)
10. susceptible to frost heave
11. shallow depth to bedrock or impermeable layer
12. excessive gravel
13. unfavorable organic matter content
14. insufficient sand content

15. insufficient gravel content (2-80 mm size)

16. shallow depth of sand and/or gravels

17. excessive thickness of soil overlying sand and gravel deposit

Appendix No. 5

SOIL INTERPRETATIONS FOR SEPTIC TANK ABSORPTION FIELDS

Map Unit \ Item Affecting	Permeability Class	Depth to Water Table	Flooding	Slope	Depth to Impervious Materials	Stoniness Class	Rockiness Class	Overall Rating
1	S	E	E	S	S	S	S	$E^{1,2}$
2	S	S	E	S	S	S	S	M^{2}
3	S	S	E	S	S	S	S	M^{2}
4	S	E	E	S	S	S	S	$E^{1,2}$
5	S	E	E	S	S	S	S	$E^{1,2}$
6	S	M	E	S	S	S	S	M^{2}_{1}
7	E	E	E	S	S	S	S	$E^{1,2,3}$
8	E	E	E	S	S	S	S	$E^{1,2,3}$
9	S	E	E	S	S	S	S	$E^{1,2}$
10	S	M	M	S	S	S	S	$M_{1,2}$
11	S	S	M	S	S	S	S	M^{2}
12	S	S	M	S	S	M	S	M^{2}
13	M	S	M	M	S	S	S	$M^{1,2,3}$
14	S	S	S	S	S	S	S	S
15	S	S	S	E	S	S	S	M^{4}
16	M	S	S	E	S	S	S	M^{4}_{3}
17	M	S	S	E	S	S	S	M^{4}_{3}
18	E	S	S	S	S	S	S	M^{4}
19	E	E	M	S	S	S	S	$E^{1,3}_{2}$
20	S	M	E	S	S	S	S	M^{2}_{1}
21	M	M	S	S	S	S	S	$M_{2,3}$
22	S	S	S	E	S	S	S	M^{4}
23	S	S	S	M	S	M	S	$M_{4,5}$
24	M	S	S	S	S	S	S	M_{3}
25	M	S	S	E	S	M	S	$M^{4}_{3,5}$
26	M	S	S	M	S	M-E	S	$M_{3,4,}$
27	M	S	S	E	S	M-E	S	$M^{4}_{3,5}$
28	M	S	S	E	S	S	M	$M^{4}_{3,6}$
29	M	S	S	M-E	S	S	M	$M_{3,4,}$
30	S	S	S	M-E	S	S	M	$M_{4,6}$
31	M	S	S	S	S	S	S	M_{3}
32	M	S	S	E	S	S	S	M^{4}_{3}
33	E	E	S	E	E	S	E	E^{7}
34	E	E	S	E	E	S	E	E^{7}
35	M	E	E	S	S	S	S	$E^{1,2}_{3}$

Appendix No. 6

SOILS INTERPRETATION RATINGS FOR DWELLINGS

Item Affecting Unit Use	DRAINAGE		SEASONAL WATER TABLE		Flooding	Slope	Shrink-Swell Potential	Unified Soil Group	Potential Frost Action	Stoniness Class	Rockiness Class	DEPTH TO BEDROCK		OVERALL RATING	
	With Basements	Without Basements	With Basements	Without Basements								With Basements	Without Basements	With Basements	Without Basements
1	E	E	E	E	E	S	S	S	S	S	S	S	S	$E^{1,2,8}$	$E^{1,2,8}$
2	E	M	E	E	E	S	S	S	S	S	S	S	S	$E^{1,2,8}$	$E^{1,2}_{8}$
3	E	E	E	E	E	S	S	S	S	S	S	S	S	$E^{1,2,8}$	$E^{1,2,8}$
4	E	M-E	E	E	E	S	S	M	M	S	S	S	S	$E^{1,2,8}$	$E^{1,2}_{8}$
5	E	E	E	E	E	S	S	S	S	S	S	S	S	$E^{1,2,8}$	$E^{1,2,8}$
6	S	S	M	M	E	S	S	M	M	S	S	S	S	M^{2}	M^{2}
7	E	E	E	E	E	S	S	M	M	S	S	S	S	$E^{1,2,8}$	$E^{1,2,8}$
8	E	E	E	E	E	S	S	M	M	S	S	S	S	$E^{1,2,8}$	$E^{1,2,8}$
9	E	E	E	E	E	S	S	M	M	S	S	S	S	$E^{1,2,8}$	$E^{1,2,8}$
10	M-S	S	M	S	E	S	S	S	S	S	S	S	S	M^{2}	M^{2}
11	S	S	S	S	E	S	S	S	S	S	S	S	S	M^{2}	M^{2}
12	S	S	S	S	E	S	S	S	S	M	S	S	S	M^{2}_{5}	M^{2}_{5}
13	S	S	S	S	M	M	S	M	M	S	S	S	S	M_{7}	M_{7}
14	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
15	S	S	S	S	S	E	S	S	S	S	S	S	S	M^{4}	M^{4}
16	S	S	S	S	S	E	S	S	S	S	S	S	S	M^{4}	M^{4}
17	S	S	S	S	S	E	S	S	S	S	S	S	S	M^{4}	M^{4}
18	S	S	S	S	S	S	S	M	M	S	S	S	S	$M_{9,10}$	$M_{9,10}$
19	M	S	M	S	S	S	S	M	M	S	S	S	S	M_{7}	$M_{9,10}$
20	S	S	M	S	E	S	S	S	S	S	S	S	S	M^{2}_{1}	M^{2}
21	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
22	S	S	S	S	S	E	S	S	S	S	S	S	S	M^{4}	M^{4}
23	S	S	S	S	S	M	S	S	S	M	S	S	S	$M_{4,5}$	$M_{4,5}$
24	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
25	S	S	S	S	S	E	S	M	M	M	M	S	S	M^{4}_{7}	M^{4}_{7}
26	S	S	S	S	S	M	S	M	M	M-E	M	S	S	M_{7}	M_{7}
27	S	S	S	S	S	E	S	M	M	M-E	M	S	S	M^{4}_{7}	M^{4}_{7}
28	S	S	S	S	S	E	S	M	M	S	M	M	S	M^{4}_{7}	M^{4}_{7}
29	S	S	S	S	S	M	S	M	M	S	M	S	S	M_{7}	M_{7}
30	S	S	S	S	S	M	S	M	M	S	M	S	S	M_{7}	M_{7}
31	S	S	S	S	S	S	S	M	M	S	S	S	S	$M_{9,10}$	$M_{9,10}$
32	S	S	S	S	S	E	S	M	M	S	S	S	S	$M^{4}_{9,10}$	$M^{4}_{9,10}$
33	S	S	S	S	S	E	S	S	S	S	E	E	E	$E^{4,6,11}$	$E^{4,6,11}$
34	S	S	S	S	S	E	S	S	S	S	E	E	E	$E^{4,6,11}$	$E^{4,6,11}$
	E	M-E	E	E	E	S	S	E	E	S	S	S	S	E^{7}	E^{7}

Appendix No. 7

SOIL LIMITATIONS AFFECTING WATER RESERVOIR AREAS AND/OR SEWAGE LAGOONS

Map Unit / Item affecting use	Depth to Water Table	Permeability	Depth to Bedrock	Slope	Coarse Fragments (<10")	% Surface Area >10" Coarse Fragments	Organic Matter	Flooding	Unified Soil Group	Overall Rating
1	E	M	S	S-M	E	S	S	E	M	$E^{1,2,12}_{4,9}$
2	E	M	S	M	E	S	S	E	M	$E^{1,2,12}_{4,9}$
3	E	M	S	M	E	S	S	E	M	$E^{1,2,12}_{3,4,9}$
4	E	E	S	S-M	E	S	M	E	M	$E^{7}_{9,13}$
5	E	E	S	S	E	S	S	E	M	E^{7}_{9}
6	M	M	S	S	S	S	S	S	M	$M_{1,3,9}$
7	E	M	S	S	S	S	M	E	M	$E^{1,2}_{3,9,13}$
8	E	M	S	S	S	S	S	E	M	$E^{1,2}_{3,9}$
9	E	M	S	S	S	S	S	E	M	$E^{1,2}_{3,9}$
10	M	E	S	S	E	S	S	E	M	$E^{2,3,12}_{1,9}$
11	S	M	S	S	E	S	M	M	M	M^{12}_{7}
12	S	E	S	S-M	E	E	S	E	M	E^{7}_{9}
13	S	M	S	E	S	S	S	S	M	$M^{4}_{3,9}$
14	S	E	S	S-M	E	S	S	S	M	$E^{3,12}_{9}$
15	S	E	S	E	E	S	S	S	M	$E^{3,4,12}_{9}$
16	S	M	S	E	M	S	S	S	M	$M^{4}_{3,9,12}$
17	S	M	S	E	M	S	S	S	M	$M^{4}_{3,9,12}$
18	S	M	S	S-M	M	S	S	S	M	$M_{3,9,12}$
19	M-E	S	S	S	S	S	S	M-E	M	$M_{1,2,9}$
20	S	M	S	M	S	S	S	E	M	$M^{2}_{3,4,9}$
21	S	M	S	S-M	M	S	M	S	M	M_{7}
22	S	M	S	E	M	S	M	S	M	M^{4}_{7}
23	S	M	S	M	M	S	M	S	M	M_{7}
24	S	M	S	S-M	M	S	S	S	M	M_{7}
25	S	M	S	E	M	M	S	S	M	M_{7}
26	S	M	S	M	M	M	S	S	M	M_{7}
27	S	M	S	E	M	M	S	S	M	M^{4}_{7}
28	S	M	S-M	E	M	M	S	S	M	M^{4}_{7}
29	S	M	S	M	M	M	S	S	M	M^{4}_{7}
30	S	M	S	M	M	M	S	S	M	M^{4}_{7}
31	S	M	S	S-M	M	S	S	S	M	M^{4}_{7}
32	S	M	S	E	M	S	S	S	M	$M^{4}_{3,9,12}$
33	S	S	E	E	NA	E	S	S	NA	$E^{4,11}$
34	S	S	E	E	NA	E	S	S	NA	$E^{4,11}$
35	E	M	S	S	S	S	M	E	E	$E^{1,2,9}_{3}$

Appendix N

SOIL INTERPRETATION RATINGS — TRENCH TYPE SANITARY LANDFILLS

Map Unit \ Item affecting use	Depth to Seasonal Water Depth	Soil Drainage Class	Flooding	Permeability	Slope	Soil Texture (Dominant to 60" Depth)	Depth to Hard Bedrock	Depth to Rippable Bedrock	Stoniness Class	Rockiness Class	Overall Rating
1	E	E	E	E	S	E	S	S	S	S	E^{7}
2	E	E	E	E	S	S-E	S	S	S	S	E^{7}
3	E	M	E	E	S	S-E	S	S	S	S	$E^{1,2,3}_{8}$
4	E	E	E	E	S	S-E	S	S	S	S	E^{7}
5	E	E	E	E	S	E	S	S	S	S	E^{7}
6	E	M	M	M	S	S	S	S	S	S	$M^{1}_{2,3,8}$
7	E	E	E	S	S	S-M	S	S	S	S	$E^{1,2,8}_{9}$
8	E	E	E	M	S	S-M	S	S	S	S	$E^{1,2,8}_{9}$
9	E	E	E	E	S	S	S	S	S	S	E^{7}
10	E	S	M	E	S	E	S	S	S	S	$E^{1,3,9}_{2}$
11	M	M	M	E	S	E	S	S	S	S	$M^{3,9}_{1,2,8}$
12	M	M	E	E	S	E	S	S	M	S	$E^{2,3,9}_{1,8}$
13	S	M	S	M	S	M	S	S	S	S	$M_{3,8,9}$
14	S	M	S	E	S	E	S	S	S	S	$M^{3,9}_{8}$
15	S	M	S	E	E	E	S	S	S	S	$E^{3,4,9}_{8}$
16	S	M	S	M	E	E	S	S	S	S	$M^{4,9}_{3,8}$
17	S	M	S	M	E	E	S	S	S	S	$M^{4,9}_{3,8}$
18	S	M	S	M	S	M	S	S	S	S	$M_{3,8,9}$
19	S	S	M	S	S	M	S	S	S	S	$M_{2,9}$
20	S	S	M	M	S	S	S	S	S	S	$M_{2,3}$
21	S	M	S	M	S	S-E	S	S	S	S	$M_{2,8}$
22	S	M	S	E	E	E	S	S	S	S	$E^{3,4,9}_{8}$
23	S	M	S	E	S	E	S	S	M	S	$M^{3,9}_{5,8}$
24	S	M	S	E	S	E-S	S	S	S	S	$M^{3}_{4,8}$
25	S	M	S	M	E	M	S	S	M	M	M^{4}_{7}
26	S	M	S	M	S	M	S	S	M-E	M	M_{7}
27	S	M	S	M	E	M	S	S	M-E	M	M^{4}_{7}
28	S	M	S	M	E	M	S	S	S	M	M^{4}_{7}
29	S	M	S	M	M	M	S	S	S	M	M_{7}
30	S	M	S	E	S	M	S	S	S	M	$M^{3}_{6,8,9}$
31	S	M	S	M	S	M	S	S	S	S	$M_{3,8,9}$
32	S	M	S	M	E	M	S	S	S	S	$M^{4}_{3,8,9}$
33	S	M	S	E	E	E	NA	E	S	E	E^{7}
34	S	M	S	E	E	E	E	NA	S	E	E^{7}
35	E	M-E	E	M	S	S	S	S	S	S	$M^{1,2}_{3,8}$

Appendix No. 9

SOIL INTERPRETATION RATINGS FOR AREA TYPE LANDFILLS

ITEM AFFECTING USE / NIT	TEXTURE	THICKNESS OF MATERIAL	COARSE FRAGMENT % BY VOLUME	STONINESS CLASS	SLOPE	DRAINAGE CLASS	OVERALL RATING
1	E	S	E	S	S	E	$E^{8,9,12}$
2	S	S	S	S	S	E	M^{8}
3	E	S	E	S	S	E	$E^{8,9,12}$
4	E	S	E	S	S	E	$E^{8,9,12}$
5	E	S	E	S	S	E	$E^{8,9,12}$
6	S	S	S	S	S	N/A	S
7	S	S	S	S	S	E	M^{8}
8	S	S	S	S	S	E	M^{8}
9	S	S	S	S	S	E	M^{8}
10	E	S	E	S	S	N/A	$M^{9,12}$
11	E	S	E	S	S	N/A	$M^{9,12}$
12	E	S	E	M	S	N/A	$M_{5}^{9,12}$
13	S	S	S	S	M	N/A	M_{4}
14	E	S	E	S	S	N/A	$M^{9,12}$
15	E	S	E	S	E	N/A	$E^{4,9,12}$
16	E	S	M	S	E	N/A	$M_{12}^{4,9}$
17	E	S	M	S	E	N/A	$M_{12}^{4,9}$
18	E-S	S	S-M	S	S	N/A	$M_{9,12}$
19	M	S	S	S	S	N/A	M_{9}
20	S	S	S	S	S	N/A	S
21	E	S	E	S	S	N/A	$M^{9,12}$
22	E	S	E	S	M	N/A	$M_{4}^{9,12}$
23	E	S	E	S	S	N/A	$M^{9,12}$
24	S-E	S	S-E	S	S	N/A	$M_{9,12}$
25	M	S	M	M	E	N/A	$M_{5}^{4}{}_{,9,12}$
26	M	S	M	M-E	S-M	N/A	M_{7}
27	M	S	M	M-E	E	N/A	$M_{5}^{4}{}_{,9,12}$
28	M	S	M	S	E	N/A	$M_{9,12}^{4}$
29	S	S	E	S	M	N/A	M_{4}^{12}
30	S	S	M	S	S-M	N/A	$M_{4,12}$
31	S	S	M	S	S	N/A	M_{12}
32	S	S	S-M	S	E	N/A	M_{12}^{4}
33	E	S	N/A	N/A	E	N/A	E^{7}
34	E	S	N/A	N/A	E	N/A	E^{7}
35	E	S	S	S	S	E	$M^{8,9}$

Appendix No. 10

SOIL INTERPRETATIONS FOR SHALLOW EXCAVATIONS

Map Unit \ Item Affecting Use	Soil Drainage Class	Seasonal Water Table	Flooding	Slope	Texture to Depth to be Excavated	Depth to Bedrock	Stoniness Class	Rockiness Class	Overal Ratir
1	E	E	E	S	E	S	S	S	E^{7}
2	E	E	E	S	S-M	S	S	S	$E_{9}^{1,2,8}$
3	E	E	E	S	S-M	S	S	S	$E_{9}^{1,2,8}$
4	E	E	E	S	S-M	S	S	S	$E_{9}^{1,2,8}$
5	E	E	E	S	E	S	S	S	E^{7}
6	M	M	M	S	S	S	S	S	$M^{1,2,8}$
7	E	E	E	S	S	S	S	S	$E^{1,2,8}$
8	E	E	E	S	S	S	S	S	$E^{1,2,8}$
9	E	E	E	S	S	S	S	S	$E^{1,2,8}$
10	M	M	M	S	M-E	S	S	S	M_{7}
11	S	M	M	S	M	S	S	S	$M_{1,2,9}$
12	S	M	M	S	E	S	M	S	$M_{1,2,5}^{9}$
13	S	S	M	M	M	S	S	S	$M_{2,5,9}$
14	S	S	S	S	E	S	S	S	M^{9}
15	S	S	S	E	E	S	S	S	$M^{4,9}$
16	S	S	S	E	M-E	S	S	S	M_{9}^{4}
17	S	S	S	E	M-E	S	S	S	M_{9}^{4}
18	S	S	S	S	M	S	S	S	M_{9}
19	M	M	M	S	M	S	S	S	M_{7}
20	S	M	M	S	M	S	S	S	$M_{1,2,9}$
21	S	S	S	S	M-E	S	S	S	M_{9}
22	S	S	S	E	E	S	S	S	$M^{4,9}$
23	S	S	S	S-M	M	S	S	S	$M_{4,9}$
24	S	S	S	S	S-M	S	S	S	S
25	S	S	S	E	M	S	M	M	$M_{5,6,9}^{4}$
26	S	S	S	S-M	M	S	M-E	M	M_{7}
27	S	S	S	E	M	S	M-E	M	$M_{5,6,9}^{4}$
28	S	S	S	E	M	S	S	M	$M_{6,9}^{4}$
29	S	S	S	M	M	S	S	M	$M_{4,6,9}$
30	S	S	S	S-M	M	S	S	M	$M_{4,6,9}$
31	S	S	S	S	M	S	S	S	M_{9}
32	S	S	S	E	M	S	S	S	M_{9}^{4}
33	S	S	S	E	N/A	E	N/A	E	E^{7}
34	S	S	S	E	N/A	E	N/A	E	E^{7}
35	E	E	E	S	E	S	S	S	E^{7}

ppendix No. 11 SOIL INTERPRETATION RATINGS FOR SAND & GRAVEL SOURCE

ITEM AFFECTING USE	DEPTH TO SEASONAL WATER TABLE	THICKNESS OF DEPOSIT	DEPTH OF SOIL OVERLYING DEPOSIT	O/O COARSE FRAGMENTS 2 mm - 80 mm	O/O SAND	OVERALL RATING	COMMENTS
1	E	M	S	M	E	$E^{1,14}_{15,16}$	no sand veneer
2	E	S	S	M	M	$E^{1}_{14,15}$	-sand overlies gravel flooding hazard
3	E	S	S	M	M	$M^{1}_{14,15}$	-sand overlies gravel flooding hazard
4	E	S	S	M	M	$M^{1}_{14,15}$	-sand overlies gravel flooding hazard
5	E	S	S	M	E	$E^{1,14}_{15}$	no sand veneer flooding hazard
6	M	S	M	E	M	$M^{15}_{1,14,17}$	gravels 1 m depth
7	E	S	S	E	M	$E^{1,15}_{14}$	primarily silts flooding hazard
8	E	N/A	N/A	E	M	$E^{1,15}_{14}$	primarily silts
9	E	N/A	N/A	E	E	$E^{1,14,15}$	primarily silts
10	M	S	S	M	E	$M^{14}_{1,15}$	some flooding hazard no sand veneer
11	S	S	S	M	E	M^{14}_{15}	shallow sand veneer
12	M	S	S	M	E	$M^{14}_{1,15}$	no sand veneer 25% cobbles & boulde
13	S	N/A	N/A	E	E	$E^{14,15}$	primarily silts
14	S	S	S	M	M	$M_{14,15}$	some being mined through unit #15
15	S	S	S	M	M	$M_{14,15}$	presently being used for gravel source
	S	N/A	N/A	E	E	$E^{14,15}$	primarily silt
17	S	N/A	N/A	E	E	$E^{14,15}$	primarily silt
18	S	S	S	M	M	$M_{14,15}$	variable sand veneer over gravels
19	E	N/A	N/A	E	E	$E^{1,14,15}$	primarily silt
20	M	S	S	M	M	$M_{1,14,15}$	gravels at 1m depth
21	S	S	S	M	M	$M_{14,15}$	silt veneer over gravel has variable depth
22	S	S	S	M	M	$M_{14,15}$	silt veneer over gravel has variable depth
23	S	S	S	M	E	M^{14}_{15}	high silt content
24	S	S	S	M	M	$M_{14,15}$	sand dune veneer on cliff top
25	S	N/A	N/A	E	E	$E^{14,15}$	
26	S	N/A	N/A	E	E	$E^{14,15}$	
27	S	N/A	N/A	E	E	$E^{14,15}$	
28	S	N/A	N/A	E	E	$E^{14,15}$	
29	S	N/A	N/A	M	E	M^{14}_{15}	high silt content
30	S	N/A	N/A	M	E	M^{14}_{15}	high silt content
31	S	N/A	N/A	M	E	M^{14}_{15}	high silt content
32	S	N/A	N/A	M	E	M^{14}_{15}	high silt content
	S	N/A	N/A	E	E	$E^{14,15}$	rock
34	S	N/A	N/A	E	E	$E^{14,15}$	rock
35	E	N/A	N/A	E	E	$E^{14,15}$	organic

Appendix No. 12

SOIL INTERPRETATION FOR SOIL EROSION HAZARD

Map Unit / Problem affecting use	Depth to Impermeable Layer m.	Runoff Potential	Soil Drainage	Soil Texture	Stability of Surface Aggregate	Soil Erodibility Group	Topographic Class	Overa Ratin
1	> 2.5	low	poorly	g	high	2	A-C	S
2	> 2.5	"	"	s	high	"	C	S
3	"	"	"	s	high	"	"	S
4	"	"	"	s,g	high	"	A-C	S
5	"	"	"	g	high	"	A-B	S
6	"	"	well	ǵl	moderate	3	"	S
7	"	"	poorly	ǵl	"	3	A	S
8	"	"	"	"	"	3	A-B	S
9	"	"	"	"	"	3	"	S
10	"	"	mod.-well to well	g	high	1	A-C	S
11	"	"	well	ǵl,g	high	1	"	S
12	"	"	"	g	high	1	"	S
13	"	moderate	"	ǵ	moderate	3	E	M
14	"	low	"	g	high	1	A-C	S
15	"	high	rapidly	g	high	1	G	M
16	"	"	"	ǵ,g	mod. low	3	G	E
17	"	"	"	"	"	3	G-H	E
18	"	low	well	g,ǵ	high	1	A-C	S
19	"	"	mod. well to well	ǵ	moderate	3	B-C	S
20	"	"	"	s	moderate	2	C	S
21	"	"	well	ǵ g	moderate	3	B-C	S
22	"	moderate	"	g	high	1	F	M
23	"	high	"	ǵ,g	moderate	3	D-E	S-M
24	"	low	"	s	"	2	A-C	S
25	"	high	"	ǵ,g	"	3	G	E
26	"	low	"	"	"	2	D-E	S
27	"	moderate	"	"	"	2	G	M
28	"	"	"	"	"	2	F-G	M
29	"	low	"	gǵ	high	2	E	S
30	"	"	"	ǵ,g	moderate	2	D	S
31	"	"	"	"	"	2	A-C	S
32	"	high	rapidly	"	"	3	H	E
33	< 0.5m	"	"	ǵ	low	4	H	E
34	"	"	"	"	"	4	H	E
35	> 2.5m	low	poorly	ǵ - muck	moderate	1	A	S